Remedial Action Construction Summary Report

Sediment Cap

(June 2004 through November 2004)

McCormick & Baxter Creosoting Company

Portland, Oregon

May 2006

Task Order No. 71-03-14

ecology and environment, inc.

DEQ

State of Oregon
Department of
Environmental
Quality

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Prepared for:

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
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List of Abbreviations and Acronyms

Acronym	Definition
ACB	articulated concrete block
AINW	Archeological Investigations Northwest, Inc.
Aqua Technologies	Aqua Technologies of Wyoming, Inc.
BAA	biological assessment addendum
BNSF	Burlington Northern Santa Fe
CanAm	CanAm Marine
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COP	construction operations plan
CQAP	construction quality assurance plan
DAS	Oregon Department of Administrative Services
DEA	David Evans & Associates, Inc.
DEQ	Oregon Department of Environmental Quality
DSL	Oregon Department of State Lands
E & E	Ecology and Environment, Inc.
EMRP	environmental monitoring and reporting plan
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
ESD	Explanation of Significant Difference
GPS	global positioning system
HDPE	high-density polyethylene
LGP	low ground pressure
McCormick & Baxter	McCormick & Baxter Creosoting Company, Portland Plant
NAPL	nonaqueous phase liquid
NGVD	National Geodetic Vertical Datum

List of Abbreviations and Acronyms (Cont.)

Acronym	Definition
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
OWRD	Oregon Water Resources Department
PacRim	PacRim Geotechnical, Inc.
PCP	pentachlorophenol
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RA	remedial action
RD	remedial design
Remtech	Remtech, Inc.
ROD	Record of Decision
RPB	Russian Peat Borer
T&M	time and materials
TRM	Turf Reinforcement Mat
USACE	United States Army Corps of Engineers
WQMP	water quality monitoring plan

1 Introduction

Ecology and Environment, Inc. (E & E), under contract with the Oregon Department of Environmental Quality (DEQ), has prepared this remedial action (RA) construction summary report to document remedial actions implemented to address contaminated sediment at the McCormick & Baxter Creosoting Company, Portland Plant (McCormick & Baxter) Superfund Site in Portland, Oregon (Figure 1-1). This project is managed by DEQ under a cooperative agreement with the United States Environmental Protection Agency (EPA).

This document has been prepared under DEQ-E&E Task Order No. 71-03-14, which concerns implementation of remedial design/remedial action (RD/RA) activities at the site in accordance with the remedy described in the Record of Decision (ROD; EPA 1996), the March 1998 ROD Amendment (EPA 1998) and the August 2002 Explanation of Significant Difference (EPA 2002). The RA addressed by this document consists of the installation of a sediment cap, which was identified in the ROD as the selected sediment remedy (subsection 1.2).

1.1 Site Location and Description

Located on the east bank of the Willamette River near River Mile 7, the site encompasses approximately 41 acres on land and 23 acres in the river, which includes impacted sediment beyond the legal property boundaries. The site is situated downstream of Swan Island and upstream of St. John's Bridge. The upland portion is on a terrace of imported sand fill (dredged material placed in the early 1900s) within the floodplain of the Willamette River. The upland area is generally flat and lies between a 120-foot-high bluff along its northeastern border and a 20-foot-high bank along the Willamette River to the southwest. A sandy beach is exposed at the base of the bank except during periods of high river stage, which generally occurs during late winter or early spring.

The site is bordered by vacant industrial properties on the river and by a residential area on the bluff. Multiple Burlington Northern Santa Fe (BNSF) Railroad tracks on an embankment create the northwestern boundary of the site. The embankment extends to a railroad bridge crossing the Willamette River. A portion of this bridge is within the sediment capping area. Additionally, the Union Pacific Railroad borders the site to the northeast at the base of the bluff. An Oregon Department of State Lands (DSL) easement crosses through the in-

water portion of the site; the legally recorded DSL easement is contained in Appendix A. The entire perimeter of the upland McCormick & Baxter site is fenced, and warning signs are posted on the fences.

The property is accessed via the partially paved North Edgewater Street, which leads from Willamette Boulevard to the main gate near the northern corner of the site. The driveway leading into the property and the parking lot is paved; the remainder of the property is unpaved, covered with gravel, or vegetated. Two trailers are maintained in the parking lot area to provide office space, storage, and personnel decontamination facilities for ongoing site activities. The remaining aboveground structures on site include: a former shop building that housed a water treatment system (no longer in operation) and other equipment/supplies; a freight container located near the western property corner, which also formerly accommodated a water treatment system (no longer in operation); four aboveground tanks used for water treatment operations (no longer in operation); a small metal shed containing a water service backflow prevention device; and several utility poles. All other aboveground structures and buildings were removed during previous RA activities.

The above description was current at the end of the 2004 construction season; changes have been made since then.

1.2 Site Background and ROD Requirements

McCormick & Baxter was founded in the early 1940s to produce a variety of treated wood products during World War II. Various wood treatment processes were used at the site including pentachlorophenol (PCP), creosote formulations, ammoniacal copper/zinc arsenate, a copper/chromium/arsenic formulation, and Cellon. Site investigation between 1983 and 1990 revealed many releases of chemical compounds to soil, groundwater, and sediment. Contaminants detected at the site include polynuclear aromatic hydrocarbons (comprising about 85% of creosote constituents), PCP, arsenic, chromium, copper, and zinc. In 1990, the wood treatment operations ceased and early RAs were initiated to remove process equipment, piping, tanks, treatment formulations, and other items.

The ROD identifies selected remedies for contaminated soil, groundwater, and sediment. Over the past several years, a number of inspections, investigations, and RAs have been performed at the site. Notably, Phase I of the soil remedy was performed in 1999, where the most highly contaminated soil was excavated to four feet below ground surface and disposed of off site as hazardous waste. Clean, sandy fill was placed in those areas that were excavated. Phase II of the soil remedy entails the installation of a soil cap, which was completed in September 2005.

Groundwater remedial activities included extracting and treating groundwater, which was then released into the Willamette River (implemented in 1994 and suspended in September 2000) and installation in 2003 of a vertical barrier wall to attain hydraulic control of nonaqueous phase liquid (NAPL) and groundwater and reduce off-site NAPL migration. Groundwater/NAPL extraction has occurred since 1994, first as an automated process, but transitioning to manual methods in 1998 when NAPL recovery diminished. Monitoring to ensure that site-specific alternate concentration limits are met at compliance monitoring locations is ongoing.

The alignment of the vertical barrier wall consists of a fully encompassing wall; the downgradient portion (paralleling the Willamette River) is constructed of steel sheet pile, and the upgradient/upland portion consists of a soil-bentonite slurry wall. Post-installation groundwater monitoring had implications for the design and construction of the sediment remedy described in this report.

The remedy for sediment, as specified in the ROD, is the capping of contaminated sediment and the initiation of long-term monitoring, operation and maintenance, and institutional controls. The objectives for the remedy includ preventing humans and aquatic organisms from having direct contact with contaminated sediment and minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of federal and state ambient water quality criteria.

The RD for the sediment cap was prepared by E & E with input from the entire project team consisting of DEQ, the EPA, the United States Army Corps of Engineers (USACE), various Native American tribes[1], the National Oceanic and Atmospheric Administration (NOAA) and NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), and as will be explained hereinafter, the City of Portland. Significant design issues included determination of the river current and wave energy for design events, the effectiveness of the capping material in sequestering the contamination, identification of a capping material for NAPL seeps, minimizing the amount of material placed to address floodway issues, armoring for the riverine environment, and upland bank modifications for stability to eliminate the need for further work below ordinary high water.

A biological assessment (EPA 2002) was developed for the McCormick and Baxter site prior to construction of the subsurface barrier wall in 2003. An addendum to the biological assessment (EPA 2003a) for construction of the sediment cap was submitted by the EPA to NOAA Fisheries and the United States Fish and Wildlife Service in October 2003. A biological opinion (NOAA Fisheries 2004), pursuant to Section 7 of the Endangered Species Act (ESA), was

[1] Confederated Tribes and Bands of the Yakama Nation, Confederated Tribes of the Grand Ronde Community, Confederated Tribes of Siletz Indians, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and the Nez Perce Tribe.

issued by NOAA Fisheries in March 2004. The EPA performed a substantive compliance determination for the Clean Water Act Section 401 and Section 404 (EPA 2003b and EPA 2003c). Section 401 regulates discharge into waters of the United States through a Certification issued by DEQ. Section 404 regulates the placement of dredged and fill material into waters of the United States through a permit issued by the USACE. Under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) authority, EPA is exempt from the administrative and procedural aspects of permits but must comply with the substantive requirements of the regulations.

In December 2003, E & E completed the initial contract documents for the construction of the sediment cap, which included contract requirements, technical specifications, and drawings. Thereafter, the DEQ, with assistance from the Oregon Department of Administrative Services (DAS), solicited bids for construction of the cap. On March 9, 2004, the contract was awarded to Remtech, Inc. (Remtech), of Spokane, Washington. Notice to Proceed was issued on March 11, 2004. Construction preparations including meetings and submittal reviews were performed thereafter, but actual construction did not commence until late June 2004 in accordance with the biological opinion (NOAA Fisheries 2004), which limited in-water work to the "fish window" of July 1 to October 31, 2004. On-site construction concluded in November 2004, however, for reasons explained hereinafter, the sediment cap was not completed until September 2005.

As noted in Section 2.4, on July 15, 2004, divers discovered two City of Portland sewer lines exposed above the river bottom. The sewer lines are 20-inch and 30-inch parallel pressure lines that convey pumped sewage from the west side of the Willamette River to a treatment plant near the Columbia River. A failure of these lines would have created an environmental disaster, not only discharging raw sewage into the Willamette River, but also denying sanitary sewer access to businesses and residences along a considerable portion of the western side of the Willamette River. DEQ postponed completion of the sediment cap around the sewer lines until the exposed portions were adequately stabilized. The stabilization of the sewer lines (under a contract held by the City of Portland) and the completion of the sediment cap (under contract to DEQ) were accomplished in 2005.

1.3 Report Objectives and Organization

The purpose of this report is to:

- Provide a summary of the sediment cap installation RA site activities performed by E & E and Remtech, including descriptions of construction methods and quantities of materials installed, removed, and/or replaced;
- Explain modifications made during the RA activities to the original RA contract documents, including a discussion of why changes were made;
- Present a chronology of major events;

- Present a summary of biological and pollution control monitoring activities;
- Describe community/tribal relations;
- Present photographic documentation; and
- Document RA construction quantities and costs.

Record drawings of the sediment cap will be provided in a separate report following completion of sediment cap construction activities in 2005.

This report has been prepared in general accordance with the construction quality assurance plan (CQAP) submitted by E & E to DEQ in June 2004. The organization of this report is as follows:

- Section 2 provides details of the RA implementation including contracting and subcontracting; a summary of pre-construction and construction activities; issues, corrective actions, and project deviations; oversight and monitoring activities (i.e., environmental monitoring); health and safety; community/tribal relations; documentation (e.g., photographic documentation and record drawings); and a chronology of major events;
- Section 3 documents RA construction quantities and costs; and
- Section 4 lists the references used in this report.

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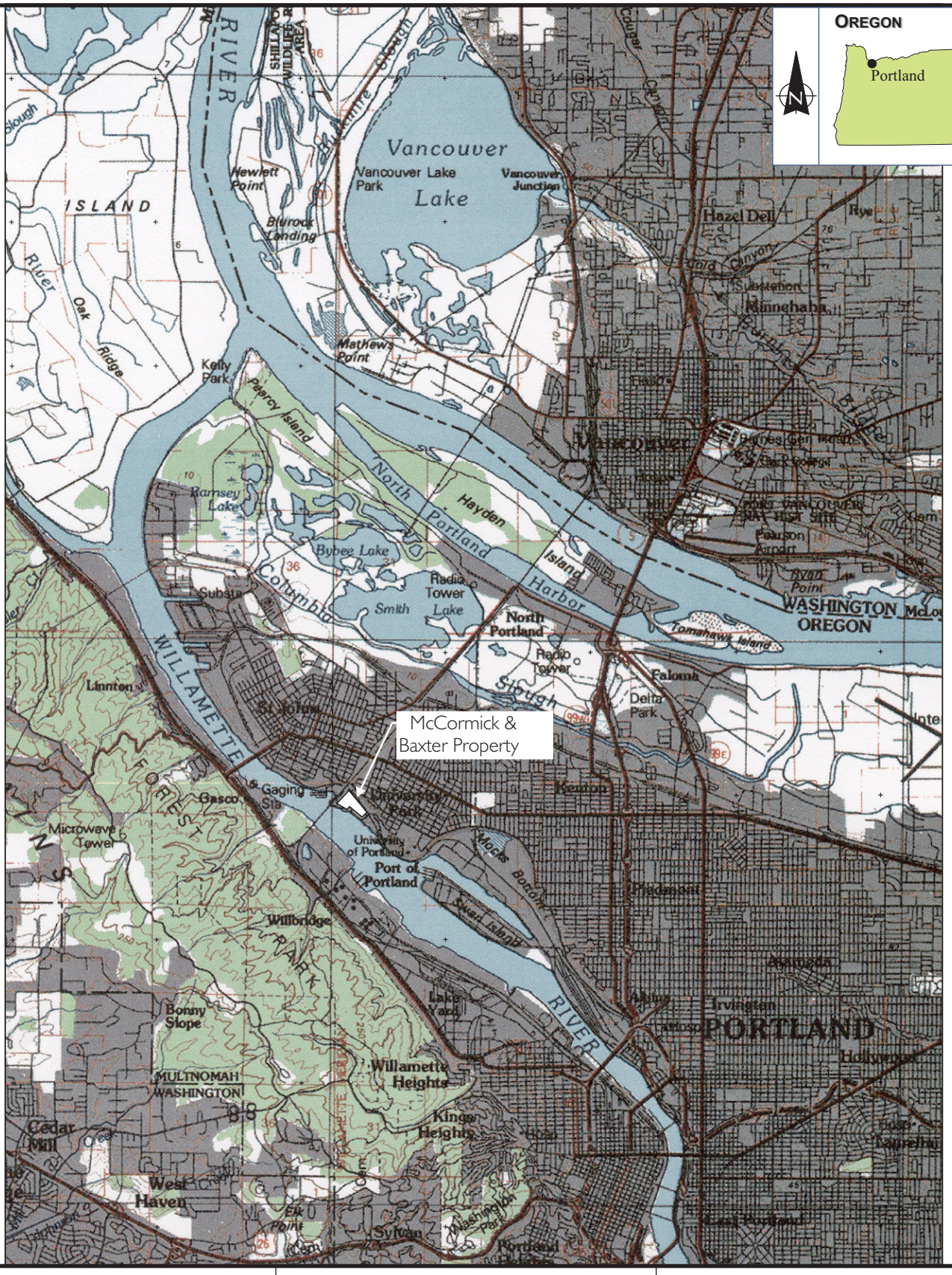

ecology and environment, inc.
International Specialists in the Environment
Portland, Oregon

McCORMICK AND BAXTER
CREOSOTING COMPANY SITE
Portland, Oregon

Figure 1-1

SITE LOCATION MAP

Date:
3-6-06

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2 Remedial Action Implementation

2.1 Contracting and Subcontracting

E & E, under contract with DEQ, provided environmental engineering and consulting services to implement RD/RA activities including oversight of RAs and the remedial contractors. Activities were conducted in accordance with the ROD, amended ROD, Explanation of Significant Difference (ESD), and DEQ task orders. E & E was responsible for preparation of work plans, implementation of field investigation activities, preparation of data summary documents, and preparation of the engineering designs and specifications related to remediation activities. E & E also provided assistance to DEQ regarding preparation of the contract documents required for procurement of the RA construction contractors.

For the RA construction phase of the project, E & E provided construction oversight services and technical management assistance to DEQ. In this role, E & E assisted DEQ with public relations, project data management, reporting and documentation, resolution of technical issues, and approval of technical submittals. During the RA, E & E provided oversight engineers to monitor contractor performance and compliance with the contract requirements, conduct inspections, and document work progress and modifications. In addition, during construction work within 100 feet of the Willamette River, E & E utilized a full time on-site biological monitor to oversee implementation of the environmental monitoring plan.

DEQ contracted the following:

- Remtech Inc., of Spokane, Washington, as the prime construction contractor.
- E & E to provide construction oversight and engineering support.
- U.S. Army Corp of Engineers (USACE), Seattle, Washington, to provide technical assistance in preparing regulatory documents.
- Archeological Investigations Northwest, Inc. (AINW), Oregon, to provide cultural resources and archeological support.

E & E subcontracted the following:

- TEG of Portland, Oregon, to provide boat transportation and miscellaneous services.
- Ellis Ecological Services of Portland, Oregon, to provide fish exclusion during appropriate portions of in-water work.
- Fred Devine Diving and Salvage of Portland, Oregon, for various underwater investigations such as collecting cores to verify sand thickness, aiding in the mapping of a slope, and verifying articulated concrete block (ACB) mat placement.
- Minister-Glaeser Surveying, Inc., of Vancouver, Washington, to perform bathymetric surveying.
- West Coast Marine Cleaning of Portland, Oregon, to provide boom deployment services when necessary.
- Hydroseeding and Bark Blowers, Inc., of Sumner, Washington, to hydroseed and blow compost over the turf reinforcement mat (TRM) along the bank.
- Pinnell Busch, Inc., of Portland, Oregon, for mediation of construction meetings and scheduling support.

After a competitive public procurement process by DAS and DEQ, the construction contract was awarded to Remtech. Remtech and their subcontractors were responsible for the physical implementation of the fieldwork specified in the contract documents. Remtech was DEQ's prime contractor for the project. As the prime contractor, Remtech provided physical labor and operations management for the project. Remtech also provided project management of the subcontractors and material/equipment vendors that were required to complete construction of the sediment cap. Subcontractor and vendor lists are provided below.

<u>Subcontractors:</u>

- Bernert Barge Lines of Portland, Oregon, provided services by barge such as deep-water sand placement, and sand and topsoil delivery to the site.
- Campbell Crane and Rigging of Portland, Oregon, provided for ACB and organophyllic clay (organoclay) placement by crane.
- CanAm Marine (CanAm) of Burlington, Washington, provided a marine superintendent, shallow water sand placement by reverse dredge, hydrographic surveying and global positioning system (GPS) tracking.
- David Evans & Associates, Inc. (DEA), of Portland, Oregon, provided bathymetric and topographic surveying services.
- Global Diving and Salvage of Portland, Oregon, provided diving services such as underwater pile cutting, debris locating, ACB and organoclay placement, and in-water loop cutting.
- Mark Marine Service, Inc., of Washougal, Washington, provided services by barge such as pile pulling, debris removal, ACB placement, and deep-water 6-inch- and 10-inch-minus placement.

- Munitor Construction of Portland, Oregon, provided shallow water gravel placement, shallow water 10-inch-minus placement, and barge demolition.
- Tacoma Pump and Drilling of Tacoma, Washington, provided well abandonment/construction and drilling services.

Vendors:

- Aqua Technologies of Wyoming, Inc. (Aqua Technologies) of Casper, Wyoming, supplied organoclay for placement as capping material over NAPL seeps.
- Contech Construction Products, Inc. of Middletown, Ohio, supplied Armortec's Armorflex ACB mats for armoring of sediment cap material, Pyramat turf reinforcement mat for placement along the bank, and orange safety fencing for demarcation.
- Halton Rental of Portland, Oregon, provided heavy construction rental equipment.
- Morse Bros., Inc. of Portland, Oregon, supplied topsoil for bank regrade and backfill and sediment capping materials, such as gravel filter, 6-inch-minus, 10-inch-minus, and riprap.
- Northwest Linings of Kent, Washington, supplied silt fencing, biobags, and erosion control mat materials.
- United Rentals of Portland, Oregon, provided general construction rental equipment.

2.2 Pre-Construction Activities

This subsection summarizes the pre-construction activities performed including meetings, submittal preparation, and permitting.

2.2.1 Pre-Construction Meetings

Prior to construction activities, a required pre-construction meeting and several additional meetings were held.

On March 11, 2004, a teleconference between DEQ, Remtech, and E & E was held as a preliminary step to the pre-construction meeting. The key conclusions of this teleconference were:

1) Organoclay: If the Aqua Technologies product was used, it could be put down in a pure, 1-foot layer tapered in some manner out to approximately 10 feet beyond the 1-foot thick boundaries. If the CETCO, Inc. product was used, it must meet the specifications in all requirements including the blending with sand.

2) Topsoil: If Remtech has a particular material that they have in mind as an alternative to the specified topsoil and fill, specific details should be provided. At a minimum, that would include

gradation and origin in order to engage in further discussion about a change to the specification language.

3) Only one submittal for each product will be accepted. If extenuating circumstances make an approved product unavailable, E & E will commit to review of an alternate product submittal within one week's time.

4) E & E would email Remtech an Adobe Acrobat version of the latest drawings that are impacted by not cutting the barrier wall. This would be followed with mailed AutoCAD drawings by Friday.

On March 22, 2004, a pre-construction meeting was held. Attendees included DEQ's project manager and contract officer; E & E's project manager, project engineer, and senior engineer; and Remtech's key project personnel including the project manager, site superintendent, and the marine subcontractor, CanAm. Topics presented and discussed during the meeting included staff introductions, a construction activity overview, project roles and responsibilities, construction schedule, submittal requirements, and change order management. E & E discovered that Remtech had misinterpreted the specifications with respect to the requirement to pull certain pilings instead of cutting them. Hard copies of the first change order drawings were provided and discussed.

On May 20, 2004, a teleconference was held between DEQ, Remtech, and E & E to clarify issues raised during review of Remtech's construction operations plan (COP). The discussion points included:

1. River current with respect to construction.
2. Sand placement.
    - Dry sand.
    - Mechanism for placement:
        * Moving evenly over the surface,
        * Placement of two layers over the entire surface, and
        * Real-time delineation of the hot spot and steep slopes.
3. Interim verification of in-water placement.
4. Turbidity.
    - Sand gradation at stockpile interior (assuming initial sampling shows material meets gradation requirements).
    - Dry sand placement.
    - Hierarchy of corrective actions in response to exceedances.
5. National Pollutant Discharge Elimination System (NPDES) permit.
6. Utilities and traffic: Information required in order to pass it on to various agencies.
7. Lines of communication.
8. Submittal review procedures.

As a part of the resolution of these issues, it was arranged for Remtech's project manager, Keith Carpenter, to come to E & E's office to discuss specifics of the COP revisions.

2.2.2 Submittals

Per Section 01300 of the contract documents for the sediment cap (E & E 2003a), Remtech and their subcontractors and/or vendors were required to prepare submittals including plans (e.g., COP, health and safety plan, etc.), shop drawings, and product data on materials and equipment. Many submittals were provided as components of the initial COP deliverable. Subsequent to that, the submittals required by the contract and resubmittals were frequently incomplete, not timely, or non-existent. On occasion, the supplier contacted E & E directly in order to obtain the requirements of the project as it related to their product. Appendix B contains product data received as submittals for the major components used in construction of the sediment cap. Other product data obtained outside of the formal submittal process are included in Appendix C.

2.2.3 Permits and Regulatory Compliance

Prior to commencing construction activities, Remtech was required to obtain a NPDES Storm Water Discharge Permit No. 1200-C from DEQ. Remtech included a copy of the barrier wall's NPDES permit in their COP (Remtech 2004). After much back and forth communication between E & E and Remtech, and after E & E's direct contact with DEQ's Water Quality Section, Remtech provided DEQ with links to Web sites that contained the contract documents and their COP.

Substantive compliance with regulations prescribed under the ESA was also required, since sediment cap construction activities had the potential to impact federally listed salmonid species (e.g., chinook salmon) in the Willamette River. The USACE, with assistance from E & E, developed a biological assessment addendum (BAA) to update the biological assessment that had been submitted for barrier wall work. Submitted on behalf of the EPA, the BAA triggered the issuance by NOAA Fisheries of an updated biological opinion (NOAA Fisheries 2004). Two additional BAAs were submitted after the contractor's construction methods were known. The first one (E & E 2004f) discussed importation of topsoil for the 2005 upland cap and the second (E & E 2004b) addressed towing pilings to the shore, operating equipment in shallow water, and grouting underwater ACB seams. The biological opinion determined that the sediment capping project was not likely to jeopardize ESA species but mandated that reasonable and prudent measures be taken during construction. The biological opinion also reiterated that the habitat enhancement features of the design, such as returning the shoreline to a more natural condition, must be implemented.

E & E developed an environmental monitoring and reporting plan (EMRP) that was used by field oversight personnel to implement conservation measures

prescribed in the biological opinion. The EMRP is included as an appendix to E & E's CQAP (E & E 2004e). See subsection 2.6.2 for additional details associated with the development and implementation of these plans.

The USACE prepared the Clean Water Act Section 401 substantive regulatory determination (EPA 2003b) for signature by the EPA. The 401 determination described measures to be taken during construction to mitigate impacts to water quality and provided the procedures to follow for notification and record keeping with respect to water quality issues.

The USACE also prepared a Clean Water Act Section 404 substantive regulatory determination (EPA 2003c) for signature by the EPA which determined that the project complied with the substantive elements of the cited regulations.

2.3 Construction Activities

Construction activities during the sediment cap implementation consisted of the following major components:

- General Mobilization and Site Preparation.
- Removal of:
  - Pilings,
  - Bulkhead and Dock Remnants,
  - In-Water Debris,
  - The Derelict Barge in Willamette Cove, and
  - Other Willamette Cove Features.
- The Sediment Cap Construction:
  - The Sand Cap,
  - Organoclay (seep areas),
  - Armoring,
  - Monitoring Well Abandonment and Modification, and
  - Bank Grading (bank regrade).
- Topsoil Importation and Stockpiling for the Proposed 2005 Upland Cap.
- Disposal and Demobilization.

There were many types of construction equipment used on this project. To facilitate reference to the equipment within this document Table 2-1 lists the commonly used equipment and how they will be referenced.

The following subsections describe in detail each of the above-listed activities that were performed during the implementation of the sediment cap.

2.3.1 General Mobilization and Site Preparation

Remtech and their contractors performed the following mobilization and site preparation activities:

- A temporary office trailer was delivered to the site and located adjacent to the existing DEQ trailer.
- Temporary connections to telephone, high-speed Internet, and electric utilities were established.
- Field lavatories were delivered.
- A "clean road" from the existing contamination reduction pad to the access gate between the Zidell property and the McCormick & Baxter site was constructed. This road was constructed to avoid contaminating the vehicles while they transported construction materials from the neighboring property.
- An equipment access road from the Metro property down to the Willamette Cove beach area was constructed.
- Temporary fenced storage compounds for material and equipment were erected.
- Orange construction fence was installed along the east property boundary of the Metro property.
- A marine contractors' access area was established on the Metro property. The contractors used this area for parking and vessel-to-shore transfer of equipment and crews.
- A marine equipment mooring area was established just off shore from the parking area where the depth of water allowed vessel access and mooring piles were available.

Before significant alteration to the construction site, the contractor flagged the clearing limits associated with site access and construction, marked trees within the clearing limits greater than 1-foot in diameter, and requested an inspection by E & E's project biologist. The project biologist performed an inspection on June 28, 2004, which included an extensive site walk of the area to identify sensitive species or habitats, if any. The project biologist found no sensitive species or habitats within the flagged clearing limits; however, she requested that the larger trees (i.e., cottonwoods and maples) along the eastern bank of Willamette Cove remain if they were not considered safety issues. The majority of vegetation within the flagged clearing limits consisted of Scotch broom brush, Japanese knotweed, blackberry, ivy, and small to medium sized cottonwood trees. The two existing site trailers were utilized by E & E, DEQ, and visitors as office and contamination reduction facilities. These two trailers are located on a paved parking lot near the entrance from North Edgewater Street in the support zone of the project. Further mobilization and site preparation performed by E & E included installation of additional signage to warn the public of activities and hazards, procurement of field supplies, setup of computer systems, and the installation of a satellite to provide Internet access.

2.3.2 Removal

2.3.2.1 Pilings

Historic heavy marine industrial activities associated with the processing and treating of timbers on the project site and other industrial activities on the

neighboring properties left the shoreline and riparian area densely covered with remnant chemically treated pilings in various stages of decomposition. Approximately 1,630 of these remnant pilings were removed. Their removal served the two-fold function of facilitating the construction of the sediment cap within the cap "footprint" and as habitat enhancement beyond the sediment cap. The following subsection describes how and where pilings were removed.

Mark Marine removed approximately 430 pilings using a crane barge with a clamshell bucket to pull them out or break them off below the mudline. The pilings were then loaded on a material staging barge (photo 1, Appendix D). The crane barge was positioned using spudbars (vertical anchoring piles attached to the sides of the barges that are driven into the river bottom) and multiple anchors. Fully loaded material barges were off-loaded at a designated area along the Metro property shoreline (downstream of the project site) where the river was deep enough to allow for barge-to-shore transfer. Removed pilings were stockpiled and processed into dumpsters for transfer to the disposal facility. Approximately 360 pilings were removed from a dilapidated dock that supported a railway at the upstream end of the McCormick & Baxter site, adjacent to the Zidell property. Approximately 70 pilings were removed within Willamette Cove as habitat enhancement.

Divers from Global Diving removed approximately 370 pilings using an underwater chainsaw. The pilings were cut off as close as practicable to the mudline. Cut pilings were then towed to the shore, picked up with an excavator, and placed in a haul truck. The haul trucks carried the piles to the Metro property area where they were processed into dumpsters for transfer to the disposal facility.

Remtech removed approximately 830 pilings from the beach area of the McCormick & Baxter property as part of the demolition of the bulkhead and dock remnants discussed in the following subsection.

The cutting and removing of pilings generated floating woody debris and occasionally an oily sheen. Oil absorbent boom was deployed around the work areas by Remtech and their contractors. The oil absorbent boom created a sufficient containment area except when wind waves, tidal action, or boat wakes caused contained byproducts to pass over or under it. Frequent efforts were made to net out the floating debris (photo 3, Appendix D).

2.3.2.2 Bulkhead and Dock Remnants

A large crane footing bulkhead and associated dock remnants, approximately midway along the shoreline between the Zidell property and the railroad bridge (STA. 15 + 00 to 18 + 00), were removed to allow for grading of the bank to a stable, more natural appearing slope and to provide for the appropriate transition from the sediment cap to the proposed upland cap.

The bulkhead included a retaining wall, which consisted of several layers of horizontal timbers with vertical pilings driven in between them. Each horizontal layer was bolted to the vertical pilings. Horizontal timbers buried within the footing were cabled to the horizontal layers as holdbacks. An excavator was utilized to dig up the soil that loaded the wall, exposing the timbers and holdback cables. Initially, chainsaws were used to cut the structural timbers, but creosote gummed up the chainsaws, the timbers were covered with embedded rocks and dirt, and the contractor feared that the laborers would encounter metal fasteners. Therefore, an excavator was used to brake and remove the timbers at or below the ground surface.

2.3.2.3 In-Water Debris

In-water debris was encountered throughout the project, which hindered the progress of construction. The contract required that a pre-construction high-resolution colorimetric bathymetric survey be performed. The results of this survey were to be used to identify debris that was greater than 2 feet above the bottom of the river. The survey results were utilized to identify areas of debris, but could not distinguish individual objects.

The expectation for the sediment cap was to cover over debris protruding less than 1-foot above the river bottom. The contractor asserted that placement was not covering the debris because the sediment was not a competent surface, and was being disturbed by the sand as it was being placed. All involved parties agreed that debris that could penetrate the layers of the sediment cap would compromise its integrity. Therefore, further dive surveys were required to identify individual objects that could possibly compromise the integrity. The Global Diving divers used buoys to mark the locations of debris that were to be removed. Removal of the debris was accomplished using a Mark Marine crane barge, when sufficient water depth allowed, and a long-reach excavator with a thumb attachment operated by Remtech personnel in shallow water.

The removed debris, metal and wood, was transported to the same processing area as the removed pilings. Wood debris was disposed as non-hazardous material and the metal was recycled.

2.3.2.4 Derelict Barge

A derelict barge was removed from the shore of the Metro property in Willamette Cove to provide further habitat enhancement. Prior to removal, AINW, a DEQ contractor, performed research into the historic significance of the vessel. The results from the research performed by AINW are documented within an Oregon Inventory of Historic Properties, Section 106 Documentation Form (Appendix E). The barge was lying perpendicular to the shore with the stern exposed on the shore and the bow buried in the river sediments. Just behind the barge was a steep faced bluff approximately 25 feet high. To facilitate removal, an access ramp was cut into the face of the bluff and excess cut material was piled up to the stern of the barge. The barge was then dismantled using two excavators. One

excavator was utilized to tear apart the barge and the other was used as debris transport (photos 48 and 49, Appendix D). As the operators removed the barge it became buoyant enough to float free of the mud, which made it possible to remove the entire barge. The specifications only required it to be removed to the mudline. The debris was carried up to the debris processing area on the Metro property. The removed material was broken down further, if necessary, and then loaded into dumpsters for transport to the disposal facility.

2.3.2.5 Other Willamette Cove Features

Demolition and Removal of Concrete Structures in Willamette Cove

Graffiti covered concrete structures on the Metro property were demolished and removed to provide habitat enhancement to the shoreline and riparian area within Willamette Cove (photo 4, Appendix D). Initially, the structures were removed to the 8-foot National Geodetic Vertical Datum (NGVD) contour, but as a result of a change order they were further demolished to the toe of the bluff along the shore, the approximate 12-foot contour. Concrete debris generated by the initial demolition was transported off site as non-hazardous material. The rubble from the second round of demolition was left on site at the request of Metro. Metro expects to utilize a concrete grinder to produce roadbed material from this and further demolition efforts on the property.

Metro Seep (Willamette Cove)

An area of seeping petroleum was encountered during the removal of pilings in Willamette Cove near the shore of the Metro property. Significant sheen and product was released when the pilings were removed (photo 7, Appendix D). Therefore, E & E and DEQ halted the removal of the pilings in this area and deployed skirted containment boom, oil absorbent boom, and oil absorbent pads. E & E investigated the seep during low water and concluded that the physical characteristics of the contamination were not typical of McCormick & Baxter site contaminants, and that the source area may be within the Metro property. DEQ contacted Metro and the Port of Portland and arranged for a limited subsurface investigation on July 8, 2004. The activities during the assessment sampling were summarized in a technical memorandum generated by E & E (E & E 2004a; Appendix C). The results from the chemical analysis performed on the samples indicated that the source area was not the McCormick & Baxter site. In order to take advantage of the resources at hand, Metro and DEQ made a cooperative agreement to have Remtech excavate the apparent source area as a change order (subsection 2.5.3) with DEQ's costs being reimbursed by Metro. Approximately 20 tons of soil were excavated and transported to a lined containment area on the concrete pad in the Metro property on October 23, 2004. Metro and their consultants were responsible for the waste characterization and disposal of the excavated material. The excavation was then filled with clean dredge sand imported for the sediment cap. The characteristics of the sediment cap sand are detailed in subsection 2.3.3.

2.3.3 Sediment Cap

The sediment cap footprint encompasses approximately 22.5 acres. Its shoreward boundary extends along the shoreline from the south end of the property downstream into Willamette Cove to the north. Its riverward boundary at the furthest offshore location extends into the Willamette River to an approximate depth of -40 feet CRD, outside of the limits of the USACE-designated navigational channel, and -10 feet CRD in Willamette Cove. The cap area also includes areas of known NAPL migration (e.g., seeps). In these areas the cap incorporated organoclay in an attempt to prevent premature breakthrough of lighter-than-water nonaqueous phase liquid (subsection 2.3.3.2).

The construction of the sediment cap was segregated into three working zones. They were as follows:

- The deep-water zone,
- The shallow-water zone, and
- The shoreline zone.

The delineation of work zones was based on the physical limitations of the construction equipment and methods, which in some areas varied with the river stage elevation. For example, at the beginning of the project some areas of the cap had to be installed with marine-based equipment, and by the end of the project the river stage had dropped enough to make installation by land-based equipment possible. In other words, areas of construction delineated as shallow-water zones at the beginning of the project became shoreline zones towards the end.

Installation control in all zones and for all types of material for the cap were based on the estimated volume of material required per unit area (grid). The general equations used by the contractor to estimate the volumes necessary were as follows:

1. [Grid Area (square feet) x Design Thickness of the Material (feet)] / 27 ft^3 = Volume (cubic yards)
2. Volume (cubic yards) x Density (tons/cubic yard) = Number of Tons Required in the Grid Area

Remtech and their subcontractors used marine positioning and survey equipment to assist in placement and tracking of materials in the deep-water and shallow-water zones. This equipment included Hypack® hydrographic software, which allows aerial progress tracking and data capture. The barge draft-displacement method was used to estimate the amount of material being placed within a given area. Draft measurements were made using weighted tape measures at designated locations on the barge. The weighted tape was dropped over the side of the barge until it touched the surface of the water and the distance between the water surface and the deck (freeboard) was recorded (photo 11, Appendix D). Remtech

provided draft/displacement charts for all delivery barges utilized during the project to convert these measurements to tonnage. The tonnage was then converted to volume based on the density of the material. Tracking during placement of the shoreline sand was the responsibility of Remtech's construction crews and superintendent.

The following subsections describe in detail the construction of the cap in different zones.

2.3.3.1 Sand Cap

The sand cap is sand placed on the Willamette River bottom and along the shore at a minimum thickness of 2 feet. As presented in the sediment cap basis for design (E & E 2002), modeling determined that this thickness protected human health and the environment. There are only two design variations to this minimum thickness requirement. The hotspot area was required to have a minimum thickness of 5 feet of sand. The slope flattening areas were required to have the minimum of 2 feet plus the additional sand sufficient to grade the slopes to an average of 2.5 Horizontal to 1 Vertical (2.5H:1V). The following subsection describes the sand imported for the cap, the equipment, the installation methods, and quality control (QC) utilized in the three zones.

Materials and Equipment

The source of the sand was an existing stockpile of Columbia River Navigational Channel maintenance dredge spoils. The USACE dredged the sand from the Upper Martin Island Bar, which is located on the Port of St. Helens property between Columbia River Miles 80 and 85 and centered on River Mile 82.8. The site is formally known as Disposal Site Upper Martin Island Bar, O-82.8. The sand was supplied to Remtech by Morse Bros., Inc., and was imported via barge by Bernert Barge Lines. The sand is primarily medium to coarse grained with low organic carbon and few fines. Gradation testing of the sand (American Society for Testing and Materials D422) shows the sand to be poorly graded with over 80% falling within the size range of United States Standard Sieve Sizes 10 and 100. A technical memorandum was produced describing the material supplied (E & E 2004c; Appendix C).

Deep-Water Zone
Sand delivery and deep-water zone sand placement were accomplished using a specialized barge (the *Inland Conveyor),* a tugboat, and a bow thruster (a small steering boat). The *Inland Conveyor* is 300 feet in length by a maximum width (beam) of 84 feet and is 16 feet 6 inches overall depth from the water surface to the bottom of the boat, (draft) plus freeboard. Fully loaded the barge draws approximately 15 feet. The sand was transferred or directly placed in deep water from the cargo hold via a series of conveyors. The unloader, a continuous bucket conveyor, was utilized to transfer the sand from the cargo hold to an articulating 100-foot long stacker, a V-belt conveyor, which dispensed the sand. During direct placement, a hopper with a 3-foot diameter pipe attachment was attached to the outlet of the stacker. The sand flowing off the stacker was directed downward by the hopper regardless of its initial trajectory (photo 15, Appendix D). The tugboat and bow thruster were used to guide the barge to and from the site and into alignment during sand placement.

Shallow-Water Zone
The shallow-water zone sand placement was accomplished using reverse dredging equipment with some additional support equipment for source material stockpiling, transferring, mixing of the dry sand with water for conveyance, and directing it to the outlet. A schematic drawing is included as Figure 2-1.

The crew of the *Inland Conveyor* utilized the bucket/belt conveyor system to load a material barge. An excavator on the material barge was used for loading sand into a 5-cubic yard hopper and screw auger for transfer to a mixer and dredge pump. This transfer equipment was mounted on the back edge (stern rail) of the material barge.

The reverse dredge pump was mounted on a pontoon style boat and was secured to the material barge using lines. The dredge pump was capable of delivering the sand mixed with Willamette River water (slurry) at 470 to 2,000 gallons per minute. This slurry was conveyed via a 10-inch diameter high-density polyethylene pipe approximately 200 feet in length.

The placement barge and outlet was a small barge with spuds, hydraulically controlled vertical anchoring poles, and hydraulically controlled anchor winches. The outlet pipe was positioned along the centerline of the barge and extended beyond the barge approximately 40 feet. Floats and cables suspended the outlet pipe with access walks on either side. Initially the outlet was an open-ended 90-degree elbow, but oversight concerns regarding high velocities at the outlet and displacement of contaminated sediment were expressed and Remtech was required to outfit the end with an energy diffuser.

Shoreline Zone
The delivery barge, the *Inland Conveyor*, was utilized to stockpile material on the shore for placement in the shoreline zone. Conventional earthwork equipment

(excavators, dump trucks, loaders, and bulldozers) was used to place and grade the sand.

Installation

Approximately 131,000 tons of sand was installed from July 7 through October 28, 2004. Installation control in all zones of the cap was based on the volume of material required per unit area. Remtech established grids and calculated the estimated volume required. The grids were loaded onto computers or drawn on placement maps. The type of survey control was dependent on the zone of placement. Marine survey equipment was utilized in the deep-water and shallow-water zones, while land-based survey was utilized in the shoreline zone.

Deep-Water Zone

The sand in the deep-water zone was placed from the *Inland Conveyor*. The approximate placement rate was 3,700 tons per day or one load every two days. The average load size was 7,500 tons. The placement was accomplished using the *Inland Conveyor*'s conveyor system and attachments. Remtech established placement grids (typically 100 feet by 100 feet). A computer was set up on the barge and a GPS receiving unit was installed at the top of the pipe attachment, allowing the crew to view the position of the outlet and the placement progress within each grid. A crewmember was stationed at the computer. His assignment was to communicate the coarse, position, and progress of placement to the captain and the bow thruster operator. The other crewmembers controlled the unloader and stacker.

With each new load of sand, Remtech personnel would deliver a sketch to the barge crewmembers showing the grids requiring placement and the amount of tons of sand that was to be placed in each grid. The crew would use this to estimate the dispensing rate and the rate at which to move the barge. The process of placement had inherent complexities and equipment limitations as the continuous bucket unloader did not deliver sand at a uniform rate. Therefore, the crew made multiple passes over the same area to minimize the possibility of excessive or inadequate placement. The amount being placed was calculated at appropriate intervals using the draft displacement method and adjustments were made to the rate of placement as necessary.

Shallow-Water Zone

CanAm performed the placement of sand in the shallow-water zone by using reverse dredge equipment. Bernert Barge Lines would normally load between 700 and 1,000 tons of sand to the material barge upon arrival or when necessary. The sand on the material barge was loaded into the hopper mounted on the stern rail. From the hopper the sand was conveyed to the mixer at water level by an auger. At the mixer it was combined with Willamette River water into slurry. The reversed dredge pump was utilized to convey the slurry to the placement barge (photo 26, Appendix D). The outlet was slowly swept in an arcing pattern across the placement grid at an established rate. Multiple passes were made over

the area to limit the possibility of over placement and to install the sand in lifts. Upon completion of the placement area attainable in the arc, the placement barge was moved by lifting one of the spuds and reeling in the appropriate anchor rode. The spud was then lowered and the process repeated using the opposing spud. The process of moving is called "walking."

Shoreline Zone
The sand placement in the shoreline zone was accomplished using land-based equipment. The crew of the *Inland Conveyor* would deliver sand to the shore. Due to the *Inland Conveyor*'s deep draft, the delivery was possible in only two locations. One location was just to the downstream side of the railroad bridge in Willamette Cove. The other location was at the neighboring Zidell property. Sand delivered to the shore was transported to the placement location with dump trucks and/or loaders. In locations of easy access a bulldozer was used to spread the sand. The depth of sand was monitored and controlled by grade stakes and direct reading markers.

Quality Control

E & E personnel were in direct contact with Bernert Barge Lines throughout the duration of the project. E & E and Bernert Barge Lines personnel would take draft measurements before and after sand offloading for material tracking purposes. The draft measurements, along with notes, were entered into a material tracking spreadsheet maintained in order to calculate the amount of sand delivered.

Deep-Water and Shallow-Water Zones
E & E stationed oversight personnel onboard the *Inland Conveyor* throughout deep-water zone sand placement. E & E personnel documented the placement progress and the procedures followed by Remtech and Bernert Barge Lines. They also performed draft measurements at appropriate intervals.

E & E observed and documented the placement procedures and progress of CanAm during shallow-water placement with the reverse dredge equipment. Quality assurance (QA) for sand cap thickness verification in deep and shallow water zones was developed and implemented by E & E. Refer to subsection 2.6 for specifics on thickness verification procedures.

Shoreline Zone
E & E observed and documented the placement procedures and progress made by Remtech during shoreline application of sand. QA of sand thickness on the shoreline zone was developed and implemented by E & E. Refer to subsection 2.6 for specifics on thickness verification procedures. Further QA inspections included inspection of the sand surface prior to placement of the filter gravel, and procedural inspections of the filter gravel and placed quantities.

2.3.3.2 Organoclay

Materials and Equipment

Approximately 600 tons (1,200,000 pounds) of organoclay was delivered to the site for coverage in two NAPL seep locations. Organoclay is bentonite or hectorite clay (manufactured by Aqua Technologies) that has been modified to be hydrophobic and to have an affinity for hydrocarbons. The organoclay was delivered to the site in super-sacks on flatbed semi-trucks. Each super-sack contained approximately 1,500 pounds of material and was made from reinforced geotextile. The sacks had integral lifting straps with loops on the top. An excavator was utilized to off-load the super-sacks and transport them to the staging areas. Excavators (normal and long reach), loaders, and cranes were used to transport and place the clay in the designated areas. Installation in the dry areas and shallow water (Willamette Cove Seep) was accomplished using a loader and a low ground pressure (LGP) bulldozer. Installation in the deeper water, greater than 3 feet, encountered in the TFA seep was accomplished using a 200-ton crane positioned on the beach, surface air supply dive crews, and support boats.

Installation

Willamette Cove Seep

DEA surveyed the location of the seep and placed stakes at the corners. The appropriate number of super-sacks (135) to obtain a 1-foot thickness and the required taper (10H:2V) were staged in the area along with sand for covering. An attempt was made to construct a wooden form to contain the placed organoclay using wood 2-by-4s and plywood. The attempt failed because the contractor was unable to anchor the form in place within the water. A method of placing full sacks intact around the outside perimeter was devised and implemented. On July 20, 2004, approximately 40 sacks were arranged around the perimeter as the form.

Immediately after the placement of the super-sack form, wooden stakes were driven in several locations and then marked 1-foot above sediment surface for gauging the thickness of the installed organoclay. Installation of the clay was initiated during low tide to maximize the area of dry installation and to minimize the installation within the water column. Two to three sacks were delivered from the staging area and suspended over the installation location by a loader or an excavator. Installation crews released the clay by cutting the bottom of the super-sack open. Then the clay was raked by hand to the level indicated on the gauging stakes. Work progressed along the shore from west to east. As the tide began to flood the area, it became apparent that the covering sand would be necessary to keep the dry clay from floating away, and that sacks acting as the form should be secured to each other began to float off. A bulldozer was utilized to push 1 to 2 feet of sand over the clay, and field crews waded out to secure sacks in the form (photo 18, Appendix D). To accomplish the covering sand placement, a portion of one side of the form had to be installed and covered. A total of 52 sacks were installed on the first day of operations, which was approximately 25 feet short of the easternmost edge. On the following day,

83 bags were deployed including the perimeter form. Once the final sacks of clay had been placed, the bulldozer operator completed the sand covering by pushing sand over the remaining area.

Tank Farm Area Seep

It was apparent from the installation difficulties in Willamette Cove that land-based equipment such as bulldozers, loaders, and crews in waders would not be appropriate for installation of the organoclay in the TFA seep. This was due to the deeper waters expected even during very low tides and the greater surface area to be covered. The contractor, therefore, used crane crews and divers to position full sacks. The full sacks were lowered into the water and left to soak prior to installation. The sacks appeared to be buoyant for approximately 24 hours and then began to sink. A turbid plume was observed during installation, but it appeared to be less when non-soaked organoclay was placed directly in the water. As the sacks were being placed in the water sand was being placed around the perimeter. This sand acted as a dam and assisted with holding the perimeter bags in place as a form. The dive crew was responsible for thickness measuring and placement control. All of the remaining organoclay was placed within the TFA seep.

Multiple methods and equipment variations were utilized to place the covering sand:

The reverse dredge system was utilized to place the sand up to and just inside the riverward edges.

- A long-reach excavator was used to place the covering sand from the shore;
- A conveyor system was utilized, with limited success, to place sand beyond the reach of the long boom; and
- A concrete bucket suspended by the crane was used to place sand beyond the reach of either of them.

The conveyor system appeared to be difficult to set up, maintain, position, and move. The concrete bucket method was slow and very costly. It required that crane crew, dive crew, and excavator and operator be dedicated to the task. It became apparent that covering the organoclay was more laborious and expensive than the installation.

The most significant difficulty encountered during installation was associated with the organoclay's hydrophobic nature. The clay particles were fully buoyant to neutrally buoyant when they were directly installed from the delivery sack to the water surface. This caused the particles and the full sacks to float. Furthermore, as the covering sand was placed some of the organoclay was displaced. Form construction, damming, and soaking the full sacks helped to minimize the difficulties, but did not completely eliminate them.

Quality Control

E & E's design engineer developed a spreadsheet to calculate the available cubic feet of organoclay. This spreadsheet included the amount purchased and the cubic feet of volume designated for the TFA seep.

Willamette Cove Seep

E & E's oversight supervisor used the spreadsheet quantity to calculate a percentage of the total amount (135 super-sacks) that was to be installed in the Willamette Cove seep. The sacks were counted during the installation to verify that the required tonnage was delivered and placed. Additional QA measures during installation included constant monitoring and recommendations that the clay be covered before high water.

Tank Farm Area Seep

E & E oversight monitors were at the location throughout the installation procedures. A sack count was not considered necessary because all of the remaining organoclay was to be placed.

2.3.3.3 Armoring

The sediment cap design incorporated different types of armoring for the sand cap. The specific armoring material and where it was installed was dependent on the expected hydraulic and physical environments (e.g., currents, wave energy, erosive energies, etc.). ACB mats were installed along the shore and in shallow water where wave action could disturb the sand. ACB is individually formed interlocking concrete blocks. Rock armor included 6-inch-minus, 10-inch-minus, and riprap. Prior to construction activities, PacRim Geotechnical, Inc. (PacRim), performed visual inspections of various rock armoring products, and a technical memorandum reported the inspection findings (PacRim 2004; Appendix C).

All shallow water 10-inch-minus and ACB armoring layers were underlain with a 4-inch thick layer of 3-inch-minus filter rock. This rock was installed to hinder the migration of the sand through the armoring layer or layers. The filter rock was installed using a folding aluminum barge with a hydraulic dump trailer secured to the deck. The following subsections describe in detail the materials and equipment used for installation, the installation, and the QC measures during installation.

To facilitate rock transportation of armoring from the staging area and placement of the near-shore areas, two types of access roads were constructed and are described as follows:

- **ACB/Shoreline Access Road –** This access road was constructed along the shoreline at the lower edge of the ACB mats from the TFA seep at approximately 15+50 and extended west to approximately STA 24+75. The road was constructed by layering geotextile material and 6-inch-minus rock (Field Directive EERT-14, Appendix F). The geotextile was

then covered with 4 inches of 3-inch-minus gravel filter rock and then approximately 15 inches of 10-inch-minus rock.

- **TFA Temporary Road –** Grid sections that were too far from shore to be covered from the ACB/Shoreline Access Road were accessed from a temporary road constructed from the northwest corner of the TFA seep along the riverward edge from approximately STA 15+50 to STA 21+00 and approximately 250 feet from shore. The contractor took advantage of the existing bottom contours of the river (shoal) when constructing the access road in this location. The road consisted of a 4-inch lift of 3-inch-minus rock, which was then covered with 10-inch-minus rock until the grade of the TFA was matched.

ACB

Materials and Equipment

Remtech selected Armortec's Armorflex® system of open-cell ACB. The individual blocks are strung into mats, interwoven with cable, for ease of transportation and installation. The concrete blocks were manufactured by Armortec and assembled into mats by Contech (an ACB vendor) on the adjacent Zidell property under a lease agreement between Remtech and the Zidell Corporation. The activities on the neighboring property were not under E & E's or DEQ's oversight jurisdiction. Black geotextile fabric was installed on the bottom of the mats with zip-ties before the mats were brought to the site (photo 40, Appendix D). The armoring design specified two different block thicknesses. The thinner blocks, 4.75-inch high, were assembled into nominal 40-foot long by 8-foot wide mats. The thicker blocks, 9-inch high, were assembled into nominal 20-foot long by 8-foot wide mats. Mat dimensions were adjusted for angle pieces to accommodate curves and work limits.

ACB mats were constructed with two different types of cables, nylon and stainless steel, in accordance with the contract documents. The contract documents required that stainless steel cables be used, at a minimum, in areas where organoclay was placed and the area above two pressurized city sewerlines to facilitate access if maintenance was required. Remtech began using stainless steel cables exclusively on the project for health and safety reasons after a mat with nylon cables failed as it was being lifted off a flatbed truck.

ACB mats were lifted using 200-ton land-based cranes during shore and near-shore installation, and by barge-mounted cranes for installation beyond the reach of the land-based cranes. Specifically designed and constructed lifting racks, referred to as a "spreaderbars," were slung from the equipment utilized during lifting operations (photo 29, Appendix D). These spreaderbars are rigid steel racks with cables and hooks affixed to the ends. Mats slung by the cable loops with the racks developed a U-shape. Ropes tied to the ends of the racks allowed control of the swing and rotation of the suspended mats. Remtech laborers and/or dive crews were used to orient and align individual mats into their

final position. Global Diving & Salvage of Seattle, Washington, provided diving services.

Taylor Trucking was subcontracted by Remtech to transport ACB mats on flatbed trucks from the assembly area on the Zidell property to the appropriate work area.

Installation
ACB installation began on July 7, 2004, and proceeded from the downstream end of the site in the Willamette Cove to the upstream work limits. Remtech graded placement sand with an I-beam held with an excavator. Installation of ACB mats was allowed only after the subgrade, including sand cap and gravel filter layer, was verified by E & E. The ACB installation was completed on October 28, 2004.

Contech/Armortec prepared the layout plan of ACB mats. ACB layouts were broken into seven separate work areas. Each individual mat had a sequential tracking number and a specific position in the plan, although full-length mats were interchangeable. Coordination was required between Remtech and Contech on which mats would be needed each day. The proximity of the storage/staging area to the work site allowed great flexibility in the installation sequence and schedule. Campbell Crane personnel moved the cranes used for ACB installation with assistance from Remtech laborers and operators.

Initially, the crane used equal length cables from the spreader bar to the lifting hoops on the ACB mats such that the mat was uniformly suspended. After a slow start and poor visibility below water in Willamette Cove, Remtech revised the ACB rigging strategy such that one end of the mat was slung lower than the other to aid in the alignment and placement of individual mats.

To anchor the upper edge of the ACB, the up-slope leading edge of ACB mats were curled into a trench with at least two blocks hanging in the trench and buried in accordance with the manufacturer's recommendations. Gaps between adjacent mats greater than 3 inches and broken blocks that were found to be unacceptable during QA/QC inspections were filled with grout (photo 42, Appendix D).

At the request of DEQ, Remtech was asked to cut the exposed lifting loops on the ACB mats. DEQ considered these loops to be a public safety hazard to people on the beach or in the water. Loop cutting was measured and paid on a time and materials basis. Remtech's method of cutting employed large hand-operated cable cutters that would become dull after a few cuts. After slow progress was observed and multiple requests were made by DEQ to develop a less time consuming and more effective method, DEQ halted cable-cutting operations. Approximately one half of the loops remain.

Quality Control
Remtech was responsible for all QC during ACB installation activities. E & E was responsible for QA inspections. It was observed by E & E that Remtech did not have sufficient survey control at the start of the ACB installation in Willamette Cove. The starting position was established using only one survey point. Contech/Armortec's ACB layout plans were supposed to be followed closely and survey control during installation is considered standard practice. Remtech would add and subtract mats as necessary to accommodate underwater contours/features and to fill in poor alignments. Large gaps in the ACB coverage were created in Area 1 due to misalignment and the installation sequence (e.g., ACB mats installed starting from a non-surveyed point underwater did not meet ACB previously installed in the same row, creating large gaps up to several feet wide). QA surveys of the limits of the ACB installed in Willamette Cove (Area 1) performed by Fred Divine Diving & Salvage Company and E & E using grade stakes placed at the work area limits by DEA, determined that the orientation of the ACB mats was skewed such that the ACB did not meet the underwater limits of work given in the contract drawings. As a result, Remtech was required to perform corrective measures and more ACB mats were installed along the riverward edge to the design limits. Another QA survey performed by Fred Divine Diving & Salvage Company and E & E in Willamette Cove near the railroad bridge (Area 2) discovered a large area not covered by ACB. Remtech was required to install ACB in this area. It was observed by E & E that Remtech began using surveyed alignment stakes in Area 3 on the east side of the railroad bridge.

Six-Inch-Minus Cobble

Materials and Equipment
The 6-inch-minus rock was basalt and/or andesite, quarried from Morse Bros., Inc.'s Watters Quarry in St. Helens, Oregon. It was mainly delivered to the site via barge. A limited amount was delivered by truck.

A Mark Marine crane barge and clamshell bucket was used to place the 6-inch-minus rock in the river.

As described at the beginning of the sediment cap section, in-water positioning software was used in conjunction with a GPS receiver to track the placement of the 6-inch-minus rock. A GPS receiving unit was placed on the end of the crane boom to approximate the location of the bucket. The GPS unit was interfaced with a computer in the crane control cab. The computer displayed the established grid pattern.

Installation
Approximately 23,250 tons of 6-inch-minus cobble were placed over the sand cap and as edge treatment where the 6-inch-minus cobble areas abutted the ACB. The 6-inch-minus rock placement area was broken up into 40 grids. Generally, the grid dimensions were 100 feet by 100 feet. To obtain the design thickness of

12 inches, a minimum of 500 tons was placed in each grid area. For grids differing in size, a proportional amount of rock was calculated and placed.

Draft measurements were collected from the 6-inch-minus rock barges at the beginning and end of each day, at the beginning and end of a barge load, at the beginning and end of a grid, and as needed to track progress during placement.

The general 6-inch-minus rock placement procedure was as follows:

- A clamshell bucket partially full of 6-inch-minus rock was obtained from the 6-inch-minus rock barge secured adjacent to the crane barge.
- Using the computer display for guidance, the crane bucket was maneuvered into position.
- The clamshell bucket was lowered to just over or just beneath the surface of the water and the 6-inch-minus rock was released.
- Triggering the tracking equipment marked the location, which appeared on the display as a 10-foot diameter circle.
- Upon aerial completion of a grid, the actual tonnage of rock placed was calculated from draft measurements.
- If the calculated amount was slightly lower than required, buckets of rock were placed across the grid in a sweeping motion until the appropriate amount was installed.

Initially planned placement procedures differed from those described above. The contractor's original plan had called for use of a rectangular-shaped skip box to be used for rock placement. The box was to be filled with an excavator and then lowered into place just above the river bottom using the crane. The box was to be emptied by opening a gate on one end of the box and lifting the other end as the crane swept across the area. This method proved to be inappropriate for several reasons: filling of the box with the excavator was time consuming and dangerous and due to the contours of the river bottom it was difficult to distribute the load evenly.

Quality Control
Several QC/QA measures were employed during the placement of the 6-inch-minus rock:

- PacRim examined the stockpile of 6-inch-minus rock at Morse Bros., Inc.'s Watters Quarry on July 28, 2004. It was found to consist of hard, durable, angular basalt and/or andesite rock that was free of defects;
- As a QA check on the mapping software, a minimum of 10% of the GPS coordinates of the placement locations were noted in a field logbook;
- As described above, tonnage checks were completed at a minimum at the beginning and end of each grid. Typically one to two more checks were completed during 6-inch-minus rock placement in each grid. These checks helped ensure even placement throughout the grid; and

- E & E/DEQ contracted divers performed visual inspections of the completed areas to ensure appropriate coverage.

The QC/QA measures noted above resulted in multiple refinements and adjustments to the contractor's installation procedures. Initially, full buckets of rock were placed just above the bottom of the river (top of the sand cap), and the placement mark was set at a 7-foot diameter circle. Through observation of the placement procedures and calculation of the tonnage placed in initial grid placement areas, it was determined by E & E and Remtech that too much material was being used. Furthermore, the result of a visual dive inspection indicated that the material was mounding. To define the problem, E & E and Remtech measured the bucket dimensions and estimated the amount of rock in a full bucket and then calculated the thickness if this amount was placed in a 7-foot diameter circle. Adjustments were made to correct the problem. The amount delivered in each bucket load was adjusted, the established mark was increased to a larger diameter of 10 feet, and the bucket loads were released at or just below the surface.

Ten-Inch-Minus Rock

Materials and Equipment

The 10-inch-minus rock used as armoring is comprised of angular basalt and/or andesite. Morse Bros., Inc., of Portland, Oregon, provided the rock to Remtech. The rock was delivered to the site by truck and was off-loaded in two different staging areas. An excavator was utilized to load the material into dump trucks for transport from the staging areas to the construction areas.

The type of equipment used for rock placement varied based on the tidal conditions of the river, river stage, and the area of placement. Rock was primarily hauled from the upland staging areas to the near-shore area of placement using 10 cubic yard dump trucks or the largest dump truck on site, the A35C (Table 2-1). Rock was spread in the areas of placement using an excavator and a LGP bulldozer. The contractor used a small outboard motor boat and a Trimble Pro XR GPS unit for the near-shore grid layout.

Occasionally, a floating conveyor belt system powered by a tow-behind portable generator was used for rock staging and rock placement during high-tide events (photo 39, Appendix D). The system was prone to numerous breakdowns and consequently, most rock placement was performed during low tide using dump trucks, bulldozers, and excavators.

Installation

Approximately 23,300 tons of 10-inch-minus rock was placed in the near-shore embayment. The primary construction components included grid design and layout, access road construction, rock staging for placement in grids, placement of 3-inch-minus gravel filter rock, and placement of 10-inch-minus rock for the sediment cap armoring.

Prior to rock installation, the near-shore area was divided into grid sections approximately 80 feet by 100 feet. Each grid was assigned a number and a set of northing and easting coordinates were determined for each grid corner. The grid corners were then located using GPS data and marked with a section of polyvinyl-chloride (PVC) pipe.

The amount of rock (in tons) per grid was calculated by the contractor based on sediment cap design specifications, which called for a 0.25-foot lift of 3-inch-minus gravel filter rock followed by a 1.25-foot lift of 10-inch-minus rock. The estimate tonnage of 10-inch-minus rock for an 80-foot by 100-foot grid is 492.6 tons.

The contractor used the known hauling capacities of the equipment (A35C) to estimate the amount of rock hauled to each grid section. Once unloaded, the rock was spread into the grid using either an excavator or a LGP bulldozer. To the extent possible, the rock was spread during low tide events to achieve the most uniform coverage. Ten-inch-minus rock that was used for the temporary road was spread out into grid sections as part of the sediment cap once the road was no longer needed

Quality Control
The contractor was responsible for the QC related to the supply and installation of materials according to the design specifications and field directives. QA was the responsibility of E & E. QA measures for the 10-inch-minus rock installation where achieved by:

- Observing and recording the number of loads of rock delivered to a grid section and verifying that they equaled the calculated amount of rock required for that section.
- Confirming with the contractor the number of loads required per grid section and the number of loads hauled to the grid section.
- Observing the rock installation within a grid section to confirm that adequate coverage was achieved.
- Verifying rock placement/coverage over the entire grid sections using a pole from a boat.

Riprap

Materials and Equipment
The riprap material used for construction of the boulder clusters and the rock mound is composed of durable angular boulders less than 3 feet in diameter.

An excavator was used to place riprap boulders into the bucket of a loader or into the A35C. The loader was used to deliver riprap to the shoreline for boulder cluster installation. The A35C was used to transport riprap around the ACB edge and place the rock mounds.

Installation
Between October 21 and October 23, 2004, approximately 558 tons of riprap was placed along the shoreline and on an offshore shoal between the embayment and the river at the McCormick & Baxter site to create a series of 10 boulder clusters and a rock mound. Each boulder cluster consisted of three boulders. The boulders were individually placed into a loader using an excavator. Operators drove the boulders onto the beach and dumped them into the specified locations marked by DEQ and E & E. These boulder clusters were incorporated into the sediment cap design as fish habitat enhancement (photos 50 and 51, Appendix D).

The rock mound area was constructed by a series of dump truck loads placed in a row. The rock was individually loaded into the A35C with an excavator and driven out to the shoal during low water. The mounds serve the two-fold function of fish habit enhancement and as wave energy-dissipating breakwater.

Quality Control
During the installation of the boulder clusters and rock mound, E & E oversight personnel observed as each boulder cluster was installed to verify proper location and quantity. Following installation, the boulder clusters and rock mounds were carefully inspected by E & E and notations were made as to the number of rocks in a cluster and the location and shape of each cluster. The environmental monitor recorded this information in his/her logbook.

Finishing Treatments

Materials and Equipment
The sand material and armoring edges were fortified against erosive forces. The design and field directives dictated the final configurations.

ACB Finishing Treatments
The materials used for ACB finishing treatments/edge treatments consisted of sand, 6-inch-minus rock, and 10-inch-minus rock.

ACB/Bank Grade Transition
The transition was accomplished by using a trench to bury the ACB, backfilling with topsoil, and nailing the TRM to the ACB mats.

Sand Cap Edges
The sediment cap design documents called for the installation of a thickened layer of 6-inch-minus rock as edge treatment along all the edges of the sand cap.

Bridge Pier Armoring Treatment
Riprap and Ten-inch-minus rock were used for armoring treatment. To accomplish this Remtech utilized a derrick barge, a supporting material supply barge, and a small tugboat.

Installation

ACB Finishing Treatments

After completion of the ACB installation, the open cells in the ACB mats were filled with covering sand (sand infill). Approximately 17,700 tons of sand were spread or placed to fill in the ACB voids. Sand in the shoreline zone was placed and spread with a rubber-tired backhoe. Sand in the shallow water zone of Willamette Cove and along the inside edge of the rock mound area was placed in rows (or windrows) using the *Inland Conveyor*. This windrow placement minimized the placement effort and utilized the ebb and flow of the tide to distribute the sand.

A thickened application of 10-inch-minus rock was placed along the edge of ACB installed in the shallow-water zone and shoreline of the embayment from approximately STA. 15+00 south. This material was placed using a backhoe. Access was possible on the ACB/shoreline access road described at the beginning of subsection 2.3.3.3. A thickened layer of 6-minus was employed along the riverward edge of the ACB installed in Willamette Cove and along the edge (riverward and shoreline) south of the railroad bridge to the 10-inch-minus finishing at approximately STA. 15+00. Installation of this material was accomplished with a backhoe and access to the area was allowed over the ACB. This allowance was based on a field demonstration that driving the backhoe on the ACB loaded with rock would not cause damage. Ten-inch-minus rock was also installed with a backhoe as edge treatment along the shoreward edge of the ACB at the base of the existing riprap where the sediment cap abutted the railroad easement in Willamette Cove. No edge treatment was installed on the easternmost ACB edge under the access road area of Willamette Cove. This area should be inspected regularly to determine if edge treatment is required in addition to the road material.

ACB/Bank Grade Transition

The uppermost shoreward edge of the ACB was treated by laying ACB (two blocks minimum) beyond the crest of the cap sand grade (17 feet NGVD), and into a V anchor trench formed between the topsoil fill and sand. The ACB edge was then covered with topsoil until the topsoil matched the 17 feet NGVD grade.

Sand Cap Edges

In deep water the sand cap edges were to have a thickened layer of 6-inch-minus rock starting from the design cap edge over a 10-foot sand taper and extending beyond the taper 5 feet with a full 2-foot thickness. The purpose of this thickened edge treatment is to provide excess armoring in the event that a score hole develops at the edge of the cap. Late in the project it was discovered by E & E that Remtech neglected to place the thickened layer except in the southern portion of the cap. Upon consultation with DEQ, it was agreed that this conservative design element could be eliminated. However, it is recommended that the edges of the 6-inch-minus armoring be inspected on a regular basis.

Bridge Pier Armoring Treatment
The original design documents called for a bridge pier armoring treatment of 10-inch-minus rock and riprap over the 6-inch-minus armor. This design was modified slightly in field directive EERT-56, which eliminated the requirement for 6-inch-minus placement on the west side of the bridge pier. Approximately 106 tons of 10-inch-minus rock was off-loaded around the bridge pier. Due to the low clearance under the bridge, the derrick of the *DB Amazon* could not be used to place the rock around the pier. Instead, the 10-inch-minus rock was off-loaded from the rock barge by the derrick on the *DB Amazon* and loaded into a skip box (a modified dump truck box) attached to the bow winch of a small tugboat and capable of dumping its payload. The tugboat was capable of maneuvering under and around the bridge pier, dumping the rock in close proximity to the pier.

Quality Control
ACB Edges
ACB edges along the shoreline and within the shallow-water placement zones were visual inspected by E & E. Divers inspected the areas that were not visible from shore.

Bridge Pier Armoring Treatment
QC methods included calculating the tonnage loaded onto the rock barge based on free board measurements and observing that the 10-inch-minus rock was evenly distributed around the pier.

2.3.3.4 Monitoring Well Abandonment and Modification

A number of wells were impacted by the installation of the sediment cap. Per the contract documents all of the existing sediment wells were to be abandoned if they could be located (SEDW-1, 3,4, and 5 and POINT A, B, and C). These wells were installed in the early 90s as part of the RI, and soon after installation became non-functional as wells due to silt. All but SEDW-5 were located and abandoned. SEDW-5 was not located and is assumed to be buried under sediment. Also per the contract documents, the monitoring wells MW-25 through 31 were abandoned. These wells were located along the shoreline; were not functional, damaged and bent by debris from the river; and were located within the area of work. Five other wells not identified during project layout and not to be used for future monitoring were abandoned (MW-Bs, EW-24s, MW-8i, MW-7s, and MW-LRs; see Table 2-2). Remtech's subcontractor, Tacoma Pump and Drilling, performed the well abandonment services.

All monitoring wells were abandoned in accordance with Oregon Water Resources Department (OWRD) requirements (e.g., boreholes were over-drilled and grouted with bentonite).

Remtech's subcontractor, Tacoma Pump and Drilling, modified a total of 36 wells during the cap construction (Table 2-2). The contract documents identified 32 barrier wall-monitoring wells, which are located within the area of work and

would continue to be utilized for monitoring. Four more wells were identified during project layout, which were within the work area (EW-24s, MW-8i, MW-7s, and MW-LRs). These wells were modified to match the finish grade created by the bank regrade.

All monitoring wells were modified in accordance with OWRD requirements (e.g., boreholes were over-drilled and grouted with bentonite).

2.3.4 Bank Regrade

The material components beneath the ACB area of the bank regrade included: capping sand and 3-inch-minus filter rock. Materials for the upland regrade (beyond the crest of the cap sand grade) included: native soils for filling of the subgrade. Remtech operators used a LGP bulldozer and several excavators on site to perform regrading of the bank and to spread capping sand. An excavator with a 20-foot long I-beam held by the bucket and thumb attachment was used to level bank regrade materials beneath the ACB (photo 14, Appendix D). Remtech also utilized a plasma torch for sheet pile wall cutting where stick-up was greater than the original barrier wall design height (e.g., along the former wooden dock).

The riverbank, prior to construction, was graded with a steep transition from the upland area at, approximately 32 feet NGVD, to the river's edge and included the bulkhead previously described in section 2.3.2.2. The riverbank was regraded to provide a smooth, more natural transition with varying slopes from 4-7H:1V, and to incorporate a terrace of approximately 18 feet in width and between 19 to 22 feet NGVD. Upland grading extended from the crest of cap sand grade at 17 feet NGVD to where the slope matched the grade of the upland area. If existing soils from the bank cut were not sufficient in quantity to accomplish the design grade the contractor was allowed to use the cut from a designated borrow area. This area was designated as the upstream end of the bank starting at approximately STA 23+00 to south edge of the site. The directive given to the contractor allowed for a variable width terrace (18 feet minimum) to obtain the needed material (Field Directive EE-RT 12, Appendix F). This directive limited the horizontal extent of the possible cut to a maximum of 230 feet from the crest of cap sand at 17 feet NGVD. Sheet piling on the northwest and southwest corners of the barrier wall and at the demolished bulkhead was cut to match the elevation of the adjacent shoreline sheet piling (photo 31, Appendix D).

The transition from the sediment cap to the regraded bank started several feet away from the final design elevation for the ACB of 17-feet NGVD. To achieve the transition imported material was required. Initially capping sand was used, but due to the large quantity and expense the contractor was allowed to use cut material from the borrow area as long as the material was not placed in the water.

Remtech was responsible for all QC during bank regrading activities. DEA was subcontracted for associated surveying activities including establishment of

horizontal and vertical survey control. Remtech used a Topcon Laser level during activities to ensure that the crest of cap sand was at 17 NGVD.

2.3.4.1 Demarcation Layer

A demarcation layer consisting of orange safety fence was laid down on top of the native subgrade material upland of the crest of the cap sand on the bank regrade areas of the sediment cap. The demarcation covered approximately 7 acres (33,880 square yards). It came in rolls approximately 5 feet wide by 50 feet long and was rolled out then stapled into place with roughly a 4-inch overlap (photo 53, Appendix D). The primary function of the demarcation layer is to act as visual warning of potentially contaminated soil during any future digging activity, which may occur on the property. E & E oversight personnel ensured that the demarcation was installed uniformly and without gaps. In some instances strong winds moved strips of demarcation. Once identified by E & E, these areas were reported to Remtech and the demarcation fabric was repaired and additional staples were installed.

2.3.4.2 Upland Bank Regrade Fill

Materials and Equipment

The source of the upland bank regrade fill was the overburden of a recently permitted gravel quarry (Reichold Quarry) owned by Morse Bros., Inc. The location of the quarry is approximately four miles north of St. Helens, Oregon, and is adjacent to Highway 30. Source area sampling and chemical analysis was performed prior to acceptance of soil. A technical memorandum presenting the results of sampling was produced (PacRim 2004) and is included in Appendix C.

Topsoil was delivered to the site by truck and by barge. Morse Bros., Inc. delivered to the site directly by truck (photos 23 and 24, Appendix D).

The fill was staged using either the A35C or a side-dump truck. From there the LGP bulldozer would spread it to proper depth and grade.

Installation

Approximately 18,000 cubic yards of fill was used to cover the upland subgrade (and demarcation) with a minimum thickness of 2 feet. The upland subgrade extends from the crest of cap sand (approximately 17 feet NGVD) upslope to the design drawing limits and between STA. 10+00 and 28+50. Remtech personnel placed a number of grade stakes marked at 26 inches to aid the LGP Bulldozer operator with depth and grade.

Quality Control

Remtech was responsible for all QC during upland bank regrade. As further QA E &E field personnel used a hand auger to dig several test pits which verified proper depth of the fill.

2.3.4.3 Turf Reinforcement Mat

Materials and Equipment

TRM is a three-dimensional geotextile specially designed for erosion control applications on steep slopes, water containment structures, and vegetated waterways. SI Geosolutions manufactured the TRM installed. The product name is Pyramat, named for the shape established by the interwoven matrix of three-dimensional geotextile. The TRM was delivered in rolls of approximately 8.5 ft x 90 ft or 85 yd^2. The matrix is composed of UV-stabilized polypropylene geofibers. The pyramid-like projections are marketed as resilient and dimensionally stable.

Twelve-inch long U-shaped wire staples were used to anchor the TRM down to the underlying soil. Initial 12-gauge wire staples were used. This gauge of wire was too thin and did not come with sharpened ends. Laborers had to work too hard to place them without bending them, and had difficulty getting them to drive all the way in without bending them to the point that they were not able to straighten them. A larger gauge was ordered and proved to be an economically adjustment. The larger gauge staples had tapered/sharpened ends that would drive easier and not bend during normal installation.

Connection of the TRM to the ACB was accomplished with cartridge driven concrete nails fitted with force distributing fender washers. The contractor supplied and installed galvanized nails with stainless steel washers.

Installation

Remtech installed approximately 23,300 square yards of TRM from November 8 through November 22, 2004. Installation of the TRM consisted of the following steps: subgrade preparation, material deployment, and anchoring. Deployment was relatively quick where as the installation of approximately 80,000 staples and anchoring the TRM to the ACB was very labor intensive and time consuming.

Prior to TRM installation, workers prepared the surface by removing large rocks, dirt clods, raking, and removing other obstructions that may have prevented the TRM from making direct contact with soil (photo 57, Appendix D). A terminal anchor trench was excavated approximately 2 to 3 feet shoreward from the crest of slope and along the upstream and downstream edges. The manufacturer recommended trench is 1-foot deep by 6-inches wide. The TRM was to be laid into the anchor trench stapled, backfilled, and then lapped back over the backfill and stapled again at the brake in grade. However, Remtech chose to use the equipment on-site (backhoe) with a 12-inch wide bucket to excavate the trench, which made the terminal trench 1-foot deep by 1-foot wide (photo 56, Appendix D). Because of this extra wide trench with twice the bearing load, E & E and DEQ determined that the lap over was not necessary and could be eliminated to save time and material.

Deployment was initiated at the top of slope and preceded down slope. The material was unrolled a few feet, laid into the anchor trench and secured with staples at 1-foot intervals. The rolls were then unrolled/deployed down slope. Adjacent rolls were placed with the upriver material over the downriver material a minimum of 4-inches. As an interim measure the overlaps were anchored (tacked) with staples every 54 inches to allow for continued deployment during stapling and anchoring. Typically the length from the anchor trench to the ACB was longer then a roll. Therefore, roll ends were overlapped or 'shingled' with the upslope roll end over the downslope beginning a minimum of 6-inches. The outer edges of the TRM were placed in an anchor trench in the same manner as at the top of slope. Anchor trenches were backfilled and compacted with the backhoe bucket.

Stapling activities were as follows: overlapped adjacent rolls were stapled at 18-inch intervals; the interior area was stapled at a frequency of 2.5 staples per square yard; and the overlapping roll ends were stapled at 1-foot intervals (photo 58, Appendix D). Remtech placed 4 staples where TRM was cut to install around monitoring wells,

The TRM was anchored to the ACB by shooting power-driven nails with a 1-inch stainless steel fender washer into the concrete of the ACB. Prior to connecting the TRM to the ACB, workers filled voids in the ACB with sand and then swept the ACB clean. Workers shot in two rows of nails with 6 inches between rows. Nails along the rows were at 24-inch centers and the nails in one row were staggered with the nails in the other row. Two additional nails were shot in along overlapped adjacent edges. Workers took care not to shoot the nails into the thin concrete section of the ACB nor near the edge of the thicker concrete sections. Workers were unable to shoot all the nails in correctly due to the ACB mat configuration and layout and variance in the concrete. The nail gun used had different power settings and it took several shots to get the nail to seat flush, however the varying hardness of concrete caused some nails to have too much power thus cracking the block, and others not having enough power to not fully seat.

Quality Control

E & E personnel provided thorough oversight during the TRM installation process. As the material was deployed, E & E checked that the appropriate overlaps were achieved, that staples and nails were placed at all appropriate intervals, and that all other installation components had been executed correctly. E & E personnel used marking paint to indicate deficiencies areas such as missing staples or inadequate overlapping. It was observed that overlaps became inadequate when mats were pulled too taut or stress was applied by walking. Under DEQ and E & E's direction, Remtech was instructed to reinforce the inadequate overlaps by stapling every 3 inches along the overlap.

2.3.4.4 Hydroseeding

Materials and Equipment

A decision was made to underlay the seed with a layer of compost instead of the contract specified topsoil. Blowers were used to apply the compost onto the TRM. The compost complied with all local, state, and federal regulations. Detailed chemical analysis of the compost can be found in Appendix C.

The hydroseed mixture was comprised of a mulch matrix accompanied by fertilizer, tackifier, seed mix, and lime. The seed mix is engineered such that an early germination of sterile vegetation will temporarily stabilize the slope during winter 2004-2005. This early germination is followed by a second germination containing a variety of native (non-sterile) seeds to permanently cover the slope. The composition of the seed mixture used is described in Table 2-3.

Initially three blower trucks were used to apply the compost to the TRM covered area, however, due to the condition of the road only two were able to navigate the site. Two of the three blower trucks could hold 32 cubic yards of compost; the other could hold 24 cubic yards.

Two hydroseeding trucks were on-site for the task. Each truck had a hopper that held enough hydroseed mixture to cover 0.5 acre. The hydroseed mixture was loaded from a platform on top of the hopper then mixed with water. The hopper made use of a built in agitator to mix all the components of the hydroseed with water (photo 65, Appendix D).

Installation

Approximately 1,404 cubic yards of compost were spread at a minimum thickness of 2 inches over roughly 6 acres of TRM covered bank/slope.

The first load of compost arrived on November 22, 2004. The compost was trucked to the site in 45 cubic yard loads then unloaded onto an uncontaminated area of the site. Hydroseeding and Barkblowers, Inc., provided a loader, which was used to load the compost from the stockpile into the hopper on the blower trucks. The blower trucks then drove out to the edge of the fill material where they parked and walked a large (4-inch diameter) hose onto the TRM covered area and blew out the compost (photo 61, Appendix D). All the workers were informed never to drive on the TRM covered surface, or within 100 feet of the river. The entire process took seven days.

Approximately 7 acres were hydroseeded including the 6 acres covered with compost, plus 1 acre near Willamette Cove where the barge demolition severely altered the riparian vegetation.

The hydroseeding began November 29, 2004. The trucks arrived with all necessary components of the hydroseed mixture staged on top of the hopper, then parked near a hydrant, and mixed the components of the hydroseed mixture with

water the components are listed in Table 2-4. One truckload of this mixture covered roughly 0.5 acre. The hydroseed mixture was distributed in two ways; with a canon from the truck (photo 63, Appendix D), and by blowing with a hose. The hydroseed drivers were told not to drive on the compost/TRM-covered areas or within 100 ft of the river. The hydroseed trucks drove to the edge of the fill material, parked, then walked a hose (2-inch diameter) out to the bottom of the compost/TRM covered area and sprayed the hydroseed mixture upwards onto the compost, thus keeping any fertilizer from getting too close to the river. The hose method was used to apply hydroseed to about 20 feet at the bottom of the compost/TRM-covered area. The canon method was often times used simultaneously with the hose method. One man would operate a high-pressure canon mounted on top of the hopper. The cannon method was used to cover all but the bottom 20 feet covered by the hose method.

Quality Control

Before delivery of compost, the subcontractor (Hydroseeding and Bark Blowers, Inc.) had an analysis run by Soil Control Lab. The analysis consisted of methods: EPA 3050B / EPA 6010, TMECC 04.12-B / 04.12-A, TMECC 04.06 / EPA 7471, and Standard method 9221 E. A copy of the letter of submittal (Wilbur-Ellis 2001), which contains test results, is included in Appendix C.

E & E oversight personnel were on site for all stages of the hydroseeding process. To ensure the compost was a minimum of 2 inches thick, E & E oversight personnel walked the compost-covered area and randomly checked the depth of compost using pen with a 2" mark on it. The depth was randomly checked at 2000+ points. Points that did not meet the minimum depth were flagged using 1' marking flags. E & E oversight personnel notified a supervisor from Hydroseeding and Barkblowers Inc. that the area was not to standards then and made sure that more product was placed to meet the minimum depth.

E & E oversight personnel watched closely as the hydroseed trucks were loaded with the hydroseed mixture to ensure proper amounts of each component. As hydroseed was applied oversight personnel watched for over spray form the cannon getting near the river, and to make sure the entire are was thoroughly covered.

2.3.5 Topsoil Stockpile

2.3.5.1 Materials and Equipment

The source of soil imported as bank regrade fill and stockpile material for the planned Upland Cap was the overburden of a recently permitted gravel quarry (Reichold Quarry) owned by Morse Bros., Inc. The location of the quarry is approximately 4 miles north of St. Helens, Oregon, and is adjacent to Highway 30. Source area sampling and chemical analysis was performed prior to acceptance of soil. A technical memorandum presenting the results of sampling was produced (E & E 2004c) and is included in Appendix C.

Topsoil was delivered to the site by truck and by barge. Morse Bros., Inc. delivered to the site directly by truck.

Orange plastic safety fencing was utilized as a demarcation layer between the topsoil stockpile and the existing site soils, and a protective cover was constructed of plastic sheeting, sand bags for ballast, and nylon line.

2.3.5.2 Installation

Approximately 59,000 cubic yards of topsoil was delivered to the site for use as clean fill in bank grading and as material to be stockpiled for future use in the planned Upland Cap. Approximately 18,000 cubic yards were used for grading and approximately 41,000 cubic yards were stockpiled. The topsoil was delivered from July 29 through November 23, 2004.

The topsoil stockpile is located on the southeastern portion of the site, approximately 15 feet from the fence line. Prior to topsoil importation, utilities were located and the land was surveyed. Topsoil stockpile boundaries were delineated and accepted by E & E's Oversight Engineer. Shrubs and debris were removed and the stockpile area was graded. An orange safety fencing demarcation layer was placed under the stockpile in anticipation that the base of the stockpile will be left in place as a part of the upland cap installation of 2005.

Topsoil was delivered to the Zidell property by barge and offloaded with heavy equipment by Remtech workers. Topsoil was taken from the stockpile throughout construction for use in the upland bank regrade. After completion of the bank regrade and stockpiling, the stockpile was covered with plastic sheeting and ballasted with sandbags place at 10-foot intervals and linked together with nylon line.

2.3.5.3 Quality Control

E & E oversight personnel used Time and Materials tracking sheets and observed Remtech's activities when performing work on the topsoil stockpile. Short meetings were also held each morning for Remtech and E & E personnel to discuss Remtech's plans for work on the stockpile.

The amount of topsoil material was determined based on the actual weight of material used. The barge displacement method was used to calculate the weight of material delivered to the site and transferred to the topsoil stockpile. Remtech submitted certified naval architect draft charts to E & E that were used to track topsoil delivered to the site by barge. E & E personnel observed topsoil barge offloading activities whenever advance notice was provided by Remtech. Whenever possible, E & E took beginning and ending draft measurements and calculated the tonnage of topsoil delivered. This information was entered into E & E's tracking sheet on the site computer. Remtech's draft measurements were used when E & E was unable to obtain them independently.

2.3.6 Disposal and Demobilization

Following completion of the sediment cap, Remtech performed the following demobilization activities:

- Constructed a storage pad for extra (unused) ACB;
- Transported extra ACB to storage pad;
- Blocked the access roads to the beach in Willamette Cove with large tree trunks;
- Decontaminated and demobilized construction equipment;
- Demobilized field office and other temporary facilities;
- Spread small piles of woody debris and chip;
- Repaired/replaced perimeter fencing that was removed and/or damaged during construction;
- Removed construction stakes and other construction debris along the shoreline;
- Cleaned the decontamination pad; and
- Cleared site and shoreline (McCormick & Baxter and Willamette Cove) of waste materials, rubbish, and debris (disposed off site).
- Removal of construction fencing on the eastern edge of metro property.

2.4 Chronology of Major Events

Major events that occurred during the sediment cap RA are listed below.

- **03/09/04** – The contract is awarded to Remtech.

- **03/11/04 –** Notice to Proceed is issued to Remtech. DEQ, Remtech, and E & E hold a teleconference as a preliminary step to the pre-construction meeting.

- **03/22/04 –** A pre-construction meeting is conducted. Attendees include DEQ's project manager and contract officer; E & E's project manager, project engineer, and senior engineer; and Remtech's key project personnel including the project manager, site superintendent, and the marine subcontractor, CanAm.

- **05/20/04 –** DEQ, Remtech, and E & E hold a teleconference to clarify issues raised during review of Remtech's COP.

- **06/09/04** – Change Order #4 is issued to enable Remtech to perform limited early mobilization: installation of a construction trailer, placement of temporary fencing around the Willamette Cove staging area, and crane erection.

- **06/25/04** – E & E's oversight supervisor mobilizes to the site to observe Remtech's early mobilization activities.

- **06/28/04** – E & E's project biologist performs an inspection of the clearing limits marked by Remtech.

- **07/01/04 –** Fish window opens. Mark Marine begins cutting tops off dolphins and removing pilings near the Zidell property. Willamette Cove activities commenced, including clearing trees and debris for an access road down to the beach, demolition of concrete structure, and pile pulling with an excavator. Global Diving begins underwater piling cutting; a diver cuts his thumb, which requires a visit to the emergency room.

- **07/06/04** – Pile pulling near concrete structure removal area in Willamette Cove liberates a considerable amount of heavy sheen and product. E & E collects a product sample.

- **07/07/04** – Remtech begins clearing and grubbing along the beach.

- **07/08/04** – Ellis Ecological Services begins fish exclusion; no salmon were captured. The first load of sand arrives on the *Inland Conveyor*.

- **07/09/04** – Mark Marine completes pile removal near the Zidell property and moves into Willamette Cove to remove pilings. The fish exclusion/sediment curtain fails.

- **07/12/04** – Global Diving performs visual surveys of designated underwater debris locations and the length of the piling and dolphin area (approximately 1,200 feet).

- **07/13/04** – Tacoma Pump and Drilling begins well abandonment.

- **07/14/04** – CanAm commences reverse dredging operations in Willamette Cove. Bernert Barge Lines begins deep-water sand placement in the "flatten-slope" design area on the riverside of the dolphin/piling structures. Campbell Crane begins ACB placement in Willamette Cove.

- **07/15/04** – Global Diving discovers exposed sewer lines southeast of the eastern railroad bridge pier during marking of underwater debris with buoys.

- **07/16/04** – Mark Marine removes debris marked with buoys. E & E and Remtech perform a volumetric test of sand placed in a particular area by reverse dredging operation. ACB placement operation stopped by Remtech because of concerns of payment for work to date.

- **07/19/04** – Removal of bulkhead/dock remnant and adjacent onshore pilings commences.

- **07/20/04** – Remtech begins placement of organoclay over NAPL seep in Willamette Cove.

- **07/21/04** – E & E implements coring procedure to verify thickness of sand placed in Willamette Cove. Remtech establishes a numbered 100-ft-by-100-ft block grid for use in deep-water sand placement. Organoclay placement in Willamette Cove is completed.

- **07/22/04** – Remtech encounters large mound of sand that has developed in Willamette Cove in a place previously approved for ACB installation. ACB placement is halted until the area can be graded and reverified.

- **07/26/04** – Bulkhead/dock remnant and associated piling removal is substantially completed.

- **07/27/04** – Remtech grades sand mound with an I-beam dragged by an anchor boat.

- **07/28/04** – Decontamination station is installed near Zidell property. DEA surveys ground surface of proposed topsoil stockpile area.

- **07/29/04** – First incidence in which heavy sheen accompanied by a strong odor is observed during sand placement near design "hot spot". Preparation of topsoil stockpile area commences with clearing and grubbing.

- **07/30/04** – Munitor begins gravel filter placement in Willamette Cove. Global Diving surveys shallow-water portion of exposed sewerline.

- **08/03/04** – Reverse dredge operation places sand in shallow-water area offshore of ACB design Area 7, which is located at the southeastern end of the site.

- **08/04/04** – ACB mat placement is halted due to placement beyond areas verified for adequate sand thickness. DEA surveys locations and marks ACB edges in Willamette Cove. Global Diving and E & E complete a visual survey of the ridge/wall under the railroad bridge in ACB Area 3.

- **08/05/04** – Global Diving completes visual survey of deep-water portion of exposed sewerline. E & E takes GPS coordinates of the sewerline using buoys placed by dive crew.

- **08/06/04** – Divers contracted by E & E and DEQ assist in the collection of sediment cores from deep-water areas.

- **08/09/04** – Remtech scarifies area to be used for the topsoil stockpile and places demarcation fabric.

- **08/10/04** – E & E develops field directive for ACB re-alignment in ACB Area 3. Global Diving places buoys along the ridge/wall under the railroad bridge and E & E takes GPS coordinates. Minister-Glaeser starts interim bathymetric survey as a subcontractor to E & E. ACB placement is halted in ACB Area 3 due to steep ridge/wall.

- **08/11/04** – Mark Marine removes in-water debris adjacent to ACB Area 6 with assistance from Global Diving. Remtech begins offloading topsoil from Morse Bros., Inc.'s barge for topsoil stockpile. Rocks and roots are observed in topsoil.

- **08/12/04** – Reverse dredge operations are stopped by E & E due to heavy sheen and large amounts of free product/NAPL surfacing near SEDW-4.

- **08/13/04** – E & E submits a letter of request to Remtech to modify reverse dredge operations. E & E digs test pits to verify sand thickness in ACB Area 4. Remtech begins organoclay installation at NAPL seep area west of ACB Area 6.

- **08/17/04** – E & E issues a stop work directive to Remtech due to continued NAPL releases and failure to modify reverse dredge operations as requested. Remtech begins installation of ACB mats in ACB Area 3 southeast of railroad bridge. Mark Marine begins placement of "toe treatment" rock (6-inch-minus) along ACB edges in ACB Area 3, north of railroad bridge.

- **08/18/04** – Reverse dredge operations are modified.

- **08/19/04** – E & E eliminates ACB mats under and around railroad bridge due to steep slopes and very close proximity to riprap and in the area of the exposed sewerlines.

- **08/20/04** – E & E discovers that the shoreline edge of ACB mats installed in Area 4 does not meet final grade requirement of 17 NGVD. Fred Devine Diving, subcontracting to E & E, investigates and maps underwater slopes in ACB Area 4.

- **08/23/04** – Remtech removes 13 mats in order to correct non-conforming grade in ACB Area 4.

- **08/24/04** – Bernert Barge Lines begins placing sand in Willamette Cove to correct deficiencies noted during verification. E & E expresses concern that the tugboat prop wash was displacing sand during

placement; therefore, Bernert Barge Lines changed their orientation to minimize the impacts.

- **08/25/04** – E & E confirms that ACB mats installed at the in-water edge in Willamette Cove (ACB Area 1) are not placed according to design.
- **08/27/04** – Portland fireboat arrives on site due to complaints regarding foam created by sand placement.
- **08/30/04** – Mark Marine begins placement of 6-inch-minus rock.
- **09/01/04** – Munitor begins demolition of wood barge located in Willamette Cove. Global Diving and E & E map out ridge in ACB Area 7.
- **09/02/04** – The crane used to place organoclay is demobilized.
- **09/09/04** – Remtech begins cutting ACB loops in Willamette Cove.
- **09/10/04** – Excavator tips over onto side at Zidell property while moving offloaded sand.
- **09/16/04** – Munitor begins gravel placement using conveyors at offshore of approximately Station 15 + 50.
- **09/17/04** – Munitor starts placement of 10-inch-minus rock.
- **09/20/04** – Remtech begins corrective ACB mat placement in Willamette Cove.
- **09/22/04** – Remtech commences repair of creosote corrective action areas B1, B2, and B3. Munitor begins placing gravel filter in Willamette Cove using a "mini-barge."
- **09/23/04** – Remtech begins grouting gaps in ACB mats. Global Diving begins cutting ACB loops in Willamette Cove.
- **09/27/04** – Munitor's conveyor belt breaks down, delaying movement of 10-inch-minus rock.
- **09/29/04** – Directive is issued to stop loop cutting.
- **10/04/04** –Mark Marine begins placing 10-inch-minus rock along ACB edges.
- **10/05/04** – Remtech completes ACB mat placement.

- **10/07/04** – Mark Marine begins placing 10-inch-minus rock and riprap around bridge pier.

- **10/08/04** – Remtech starts cutting the upper portion of the barrier wall along the edge of ACB Area 5A.

- **10/13/04** – Remtech begins to lay out high-density polyethylene (HDPE) demarcation for the upland regrade.

- **10/15/04** – Remtech begins placing and grading imported topsoil over HDPE demarcation.

- **10/18/04** – Tacoma Pump and Drilling commences well modification and abandonment.

- **10/19/04** – Remtech begins installing boulder clusters.

- **10/20/04** – Remtech starts placing excess ACB mats on storage pad. Remtech also begins filling sand bags for topsoil stockpile cover.

- **10/21/04** – Fred Devine Diving visually surveys underwater mats in Willamette Cove and finds three major gaps; E & E takes GPS coordinates representing the gaps and missing ACB mats. Fred Devine also visually surveys the steep slope transition and edge treatment and determines that rock placement is sufficient. Morse Bros., Inc., knocks five dolphins down at Zidell property; reportedly, the captain lost control of the barge.

- **10/22/04** – Remtech excavates and caps two small areas (approximately 3-feet diameter) where silty sediments containing NAPL sheen are observed protruding through the sand cap. Remtech begins placing riprap in rock mound area.

- **10/25/04** – Fred Divine Diving begins placement of ACB block to fill gaps.

- **10/26/04** – One of Remtech's employees falls off Mark Marine's tugboat into the water between the tugboat and derrick barge; no injuries resulted.

- **10/28/04** – Metro and Hart Crowser are on site to oversee excavation of test pits, attempting to define the lateral extent of the seep in Willamette Cove near Metro's upland property. Sand placement and ACB installation activities are completed.

- **10/29/04** – A Remtech employee drives the Volvo dump truck 35C with the box up and consequently tears down a power line from the south side of the shop; no one is injured. Portland General Electric responds within an hour.

- **10/30/04** – The last day of in-water work. E & E issues a directive to inform Remtech that any work below the OHWM shall be performed without construction equipment or vehicles.

- **11/08/04** – Remtech begins TRM placement.

- **11/12/04** – Remtech begins site cleanup and demobilization.

- **11/15/04** – In an apparent act of vandalism, the CAT 950 front-end loader sustained damage. A power pole lying nearby had apparently been used by someone operating other equipment to inflict the damage. Additionally, one of the Volvo A35C trucks had been driven into a pile of wood debris. The authorities were notified. Minor amounts of topsoil was found eroding from underneath the TRM. A 30-inch native Coho salmon was found dead on the beach; E & E notified NOAA and DEQ.

- **11/18/04** – TRM anchor trench at top of slope is backfilled. CAT 950 loader is hauled offsite without proper decontamination by Remtech.

- **11/19/04** – Remtech repairs the gate at the SE corner of the site (entrance to Zidell property).

- **11/20/04** – Remtech repairs TRM areas spray-painted by E & E that mark inadequate stapling. Remtech finishes nailing TRM to ACB.

- **11/22/04** – TRM installation is completed. Hydroseeding and Bark Blowers, Inc., under subcontract to E & E, blowing compost over TRM.

- **11/23/04** – Remtech completes topsoil stockpile cover.

- **11/24/04** – Hydroseeding and Bark Blowers, Inc., re-covers previously composted area to ensure a minimum thickness of 2 inches. E & E takes GPS coordinates of the storm sewer small access hole at the far east end of the site.

- **11/30/04** – Hydroseeding and Bark Blowers, Inc., begin hydroseeding.

- **12/02/04** – Hydroseeding is completed.

2.5 Issues, Corrective Actions, and Project Deviations

Project activities were modified in response to site conditions, requests for additional work, and adjustments to the site work directed by DEQ and E & E. The following subsections describe the issues that arose, the resulting corrective action that was taken, and the project deviations.

2.5.1 Issues

Actual site conditions encountered during construction led to modified construction activities and associated costs during the implementation of the sediment cap design.

2.5.1.1 Competency of the River Sediment

As stated previously in this report, the design engineer's assumption was that appropriately placed sand (i.e., sand placed at the appropriate settling velocity) would cover protruding objects of one-foot or less with a sand layer of approximately one foot thick. The surface would be smooth enough to accommodate the successive layers of the sediment cap (i.e., ACB or armoring with rock). The contractor's assertion was that their placement methods were appropriate and that placement was not covering the debris because the underlying river sediments were not a competent surface (unable to support the sand without settling or displacement) and were being disturbed (displaced) by the sand as it was being placed. This disagreement could have led to work stoppage and possible litigation, and could have precluded completion of construction in 2004. Therefore, changes were made to keep construction on schedule. The ramifications of this issue echoed throughout the project and caused the modification of many aspects of the construction. One of the most significant effects was the change from bathymetric survey for sand thickness measurement to direct coring. E & E assumed the responsibility of verifying sand thickness, relieving the contractor of bathymetric surveying responsibilities for thickness assurance and payment. For further details on sand cap verification see subsection 2.6.

2.5.1.2 Exposed Sewer Lines

A portion of the sediment cap was to be placed over two subsurface City of Portland pressurized sewer lines. During debris identification dive surveys at the beginning of the project, divers found that portions of the sewer lines were exposed. According to the City of Portland, the sewer lines were suppose to be buried approximately 10 feet below the river bottom.

2.5.1.3 Steep Underwater Features

Steeper (less than 2H:1V and, in a few locations, vertical) and longer than expected underwater features were encountered. The design included areas in which extra sand was to be installed to flatten slopes to 2.5H: 1V, but the design survey did not reflect the length nor the slopes that were almost vertical or vertical due to a piling wall. It became apparent while trying to address this problem that possible solutions raised concerns regarding slope stability and cost.

2.5.1.4 Quantity of Fill On Site

A considerable amount of fill was required for the bank regrade. The amount of fill exceeded the amount available when the shoreline bluff was cut.

2.5.1.5 Additional Seep Areas and Excessive Sheen Liberation

During placement of sand with the reverse dredge excessive sheen was liberated in area around the historic location of Sediment Well 4. In response to the situation E & E issued a stop work order on August 17, and then rescinded the stop work order on August 18 after Remtech supplied a written plan for modifications of the reverse dredge equipment.

2.5.2 Corrective Actions

2.5.2.1 Competency of the River Sediment

To address the issue regarding the state of the river sediment and its ability to support the cap materials without settling or displacement construction activities were modified in multiple ways. They were as follows:

- Verification of the thickness of sand placed was modified from bathymetric surveys to direct coring,
- More debris was removed to ensure the integrity of the sand cap,
- DEQ compensated Remtech for the mobilization of a long reach excavator to be utilized during near shore debris removal,
- DEQ compensated Remtech for associated delays,
- DEQ extended the number of contract days, and
- The measure and payment for sand placement was modified from bathymetric survey to the amount delivered and installed.

These modifications were considered necessary to complete the project within the construction time window dictated in the biological opinion and in an effort to ensure quality of construction.

2.5.2.2 Exposed Sewer Lines

E & E and DEQ directed the contractor to halt all construction activities near the sewer lines. The City of Portland was informed of the situation. A no work zone was established by E & E and DEQ using the available information and AutoCAD drawings of the area. Although only a small portion of the pipes were exposed, the no work zone extended beyond the exposed portion to the deep water edge because of concerns related to differential settling if the overburden load was increased. There was also no information available on the depth of the sewer lines below the bottom of the river. The no-work zone was established approximately 50 feet on both sides of the expected path of the pipes and up the bank.

2.5.2.3 Steep Underwater Features

In an attempt to define the vertical and horizontal extent of the problem, inspection dive surveys were performed. The objectives were measuring the horizontal extent and producing multiple cross-sections. To accomplish the production of cross-sections the water surface was used as a datum. Divers were able to measure the depth of water above the sediment surface to the water surface using a device that accurately measures the depth of a water column. This information was relayed to E & E field personnel along with the estimated distance the diver traveled along the bottom perpendicular to the steep slope. To accomplish the measurement of the horizontal extent of the steep areas buoys were set at each end, a GPS coordinate was taken at each buoy, and the coordinates were transcribed into AutoCAD for length. The resulting cross-sections and lengths were utilized to develop possible solution scenarios. The trade-offs for the different scenarios were examined considering the stability of the crest of a slope loaded with extra material and the over all cost for implementation.

Based on the evaluation of possible solutions and additional information from the dive survey, it was determined that the most cost effective solution for Cap construction on the steep slopes was to place additional sand; use divers to visually inspect the sand as soon as possible after it was placed; place the 6-inch-minus rock per the original design; and then use divers again to visually inspect the slope after placement. Results of the dive survey just after the sand was placed confirmed that the sand was holding the slope grade. 6-inch-minus rock was then placed per design. The post placement visual inspection by divers indicated that the 6-inch-minus rock was holding on the steep grade. Visual inspections should be performed in the future to monitor the stability of the slopes.

A considerable amount of ACB extended beyond the steep transition in the original design. The contractor was unable to install ACB on grades steeper than approximately 4H: 1V. Therefore, ACB mats were not installed within 2 to 3 feet of the break in grade.

2.5.2.4 Quantity of Fill On Site

An on-site borrow area was established by modifying the design of the bank regrade from approximately Sta. 23+00 to the south end of the regrade area (ACB Area 7). To accomplish this, the ACB layout and the upland fill limits were extended shoreward. The grade cross-sections were revised to allow for additional soil borrow.

2.5.2.5 Additional Seep Areas and Excessive Sheen Liberation

It was undetermined whether or not the sand placement technique was excessively mixing the sediment or the area was contaminated with NAPL to the extent that placement of material using alternative methods would have resulted in a similar situation. The notice of non-conformance required that Remtech modify their

placement technique, specifically related to the flow velocity and hydraulic energy at the outlet to the reverse dredge. Remtech and E & E jointly developed an outlet diffuser, which dissipated the energy through baffling and reflection of flow. This modified outlet was used during placement of sand by the reverse dredge to project completion, and appeared to work as designed.

NAPL sheen were also observed in the vicinity of the former wooden dock following placement of capping materials. These sheens and the appearance of silty sediment extruding through the capping materials occurred adjacent to a temporary haul road. It was theorized that the loading and vibrations of the heavy equipment may have extruded the contaminated, plastic-like sediments. Four of these so called "blisters" were excavated and backfilled with clean capping materials. Additionally, five feet of sand (similar to a hot spot treatment) was added to a submerged area not accessible to the excavator. This area was then armored.

2.5.3 Project Deviations

Generally the process of implementing E & E and DEQ requested changes or deviations considered necessary to the sediment cap design and construction was as follows:

- E & E, DEQ, or the Contractor identified the need for a change to the design, process of construction, contracted costs, or schedule.
- A determination of the magnitude and scope of the change was made. In order to direct the contractor or formalize changes to the contract documents, E & E and DEQ would determine whether or not the change(s) could be addressed in a field memorandum or directive, change order, or a combination of both field directive and change order.
- Changes that were believed to have minimal impacts to the construction cost or schedule were addressed in a field directive. Changes that were believed to have larger impacts to cost and schedule were formalized in change orders or initiated by field directives that indicated the changes would be formalized in future change orders.

2.5.3.1 Change Orders

By the end of the project, ten Contract Change Orders had been issued. Multiple changes were addressed in each. The change orders are included in Appendix F and summarized in Table 2-5. The table presents a brief description of the deviation and scope of the change followed by a discussion of the reason, corrective action, and result.

2.5.3.2 Field Memorandums and Directives

At the beginning of the project, field directions to the contract were conveyed to the contractor through dated field memorandums. As the number and complexity of the dated memorandums increased it became more complicated to make references in subsequent and related directives to these dated memorandums, and

difficult to respond to questions posed by the contractor regarding the memorandums. Therefore, a process of numbered field directives was implemented. The numbering of the field directives reached 95. However, three directives were not issued and therefore, at the end of the project 92 field directives and six field memorandums were issued. The field memorandums and directives are included in Appendix F, and Table 2-6 includes a brief description of each memorandum/directive, the reason for the directive, and deviations to the contract if applicable. Not all field directives had monetary or schedule impacts.

2.6 Construction Oversight

On a daily basis and as necessary, E & E's construction oversight supervisor would assign field personnel to document the importation of material, oversee construction tasks, and perform inspections on work completed. An organizational chart showing the assignments of E & E personnel is included in Appendix G. The spreadsheets used to track the imported material are provided in Appendix H.

As presented earlier in this report, oversight requirements changed due to requests for additional work or through change orders. Work that was performed as a result of a change order often became measured and paid as time and materials (T&M). T&M was monitored to the extent possible for the time construction workers performed tasks and the time and type of equipment used. The following activities were monitored on a T&M basis:

- Loop cutting,
- Area 7 bank regrade for fill,
- TFA seep organoclay placement,
- Some of the topsoil stockpiling activities,
- Additional seep repairs, and
- Debris removal.

As a result of actual site conditions as presented in Section 2.5, E & E assumed the responsibility of verifying both the sand cap placement and thickness onshore and in the river at the McCormick & Baxter site. The construction contractor would submit a written sand cap placement verification request to the E & E on-site manager that outlined a specific area to be verified. E & E personnel would view this area in AutoCAD LT 2004, determine the number and placement of sample locations necessary for verification. Once this was completed, the latitude and longitude coordinates for these locations were loaded into a Trimble GPS backpack unit with sub-meter accuracy, the verification samples were collected and the results were recorded on sample log sheets. After sampling was completed, the results transcribed into the AutoCAD LT 2004 file and the construction contractor was notified in writing, as well as verbally, the results of the verification sampling.

A variety of methods were employed to verify the sand cap placement. Onshore areas were verified using either an excavator bucket to remove 2 to 3 feet of cap material and measuring the sand cap thickness or a Russian Peat Borer (RPB) sampler. The RPB is a manually driven core sampler designed to collect uncompressed sediment samples in shallow water systems (a depth of up to 15 feet). The RPB consists of a 40-inch long stainless steel core tube, a Delrin® core head and bottom point that supports a stainless steel cover plate, 3/4-inch diameter aluminum extension rods, and a turning handle. The core tube is hinged to the cover plate, so when the core tube is manually driven into the sediment, the core tube is rotated 180 degrees clockwise, which collects a semicylindrical sediment core 2-inches in diameter. Once the RPB is in the closed position, it is removed from the sediment, opened, and the sediment profile is recorded on a sample log sheet.

In shallow river areas (a depth of 10 feet or less), the sand cap placement was verified using either the RPB or 2-inch PVC pipe to collect sediment sample cores off the side of an anchored aluminum jet boat. The coring method involved manually driving PVC pipe 3 to 5 feet into the sediment, filling the remainder of the pipe with water, capping the top, and removing the pipe from the sediment and into the boat. Once in the boat, the portion of pipe driven into the sediment was capped and the core was labeled with the location identifier using permanent marker. Later when the sample core was brought onshore, it was laid on clean plastic sheeting, cut open with a circular skill saw, and the sediment profile was recorded on a log sheet.

In deep river areas (depths between 10 to 45 feet), the sand cap placement was verified with subcontracted divers using the PVC coring method. All sample locations for deep-water areas were set along straight lines and spaced approximately 50 feet apart from each other. The divers would set up walk lines 150 feet long that were marked every 50 feet and drop each end of the line over sample locations to the sediment bottom. Then a diver would suit up in a supplied air dive outfit, dive to the sediment bottom, walk along the line to a sample location and manually collect each sediment sample by driving PVC pipe into the sediment and capping the pipe underwater. The diver would then bring the sample back to the dive boat where the sample container was labeled with a permanent marker and stored until it could be brought back onshore, opened, and the sediment profile recorded on a log sheet. Refer to Figure 2-2 for sand coring data and locations. The divers were also used to visually locate and verify the ACB mat placement in the shallow areas.

2.7 Environmental Monitoring

Prior to construction, E & E prepared an EMRP, which outlined the monitoring, documentation, and reporting procedures to be followed by oversight personnel. These procedures ensure that the measures presented in the NOAA Fisheries biological opinion were implemented.

E & E utilized a full-time, on-site environmental monitor. When construction activities were performed, monitoring included daily shoreline walks, daily turbidity monitoring (during in-water work), and daily pollution/erosion control monitoring. The contractor's procedures were monitored during all construction activities.

The environmental monitor and/or the oversight supervisor performed a daily shoreline walk. During the daily shoreline walk, the environmental monitor/oversight supervisor documented the occurrence of all sick, dead or injured fish and animals, any sheen observed in the river, and any changes to shoreline features in the daily environmental monitoring report forms.

In the event that a dead or injured endangered species was found, the environmental monitor:

- Documented the details in his/her logbook and on the daily environmental monitoring report forms, and took photos of the specimen.
- Contacted the E & E fisheries biologist to confirm species identification.
- Made initial notification to the NOAA Fisheries Law Enforcement Office, Vancouver Field Office, Vancouver, Washington.
- Reported the discovery to the DEQ Project Manager and NOAA Fisheries via email and phone as necessary.

Occasional releases of NAPL sheen were anticipated either by scouring or by compression under the weight of the capping materials. If sheen was observed on the river, the environmental monitor immediately notified the oversight supervisor who in consultation with the DEQ Project Manager decided what action to take. For large sheens, E & E contracted the services of West Coast Marine Cleaning, Inc., for additional aid in containment/cleanup. They deployed either oil-absorbent boom or a skirted containment boom, and in some incidences, a combination of both. The boom was left in place until the sheen dissipated. Smaller sheens were contained/absorbed from shore or from E & E's water quality monitoring boat.

To ensure that the State of Oregon's Water Quality Standards were met during construction and to implement the reasonable and prudent measures as prescribed in the biological opinion, E & E developed the water quality monitoring plan (WQMP), which was included in the EMRP. The on-site environmental monitor used this plan to assist with monitoring of the contractor's turbidity-minimizing procedures and construction techniques. Turbidity measurements were taken to monitor the construction activities. If turbidity readings exceeded the turbidity criteria or improper construction techniques were observed, proper notification and actions were taken.

Turbidity was monitored during all in-water construction activity. A turbidity background monitoring point was established at a representative (undisturbed)

location a minimum of 100 feet upstream from the sediment cap boundary. The background measurement location varied because of tidal influences. Turbidity sampling for compliance was monitored at points 100 feet downstream from the sediment cap boundary. In addition, monitoring occurred at the point(s) of discharge as necessary. When construction activities were within a sediment curtain, the readings were taken from just outside the curtain. Water samples/readings were collected/taken at the bottom, mid-level, and top of the water column but not closer than within 5-foot intervals. Six readings were taken from each depth then averaged for a more accurate measurement.

Turbidity measurements were taken and recorded at least once every four hours during in-water work. On any day in-water work occurred, the first sample was taken at four hours after the initiation of activity and once at each four-hour interval thereafter. If the turbidity level exceeded turbidity criteria, initial notifications were made to the Oversight Supervisor and directly to Remtech's superintendent. Following notifications, more readings were taken at the upstream and downstream sampling locations. If the upstream/downstream readings did not account for the excessive turbidity, another reading at the same location of the initial readings was taken within 30 minutes of the first. If these readings were also above the criteria, the environmental monitor notified the oversight supervisor. The turbidity-causing work was then shut down or modified, and the turbidity was measured at 30-minute intervals until it came down to acceptable levels.

Visual monitoring of turbidity levels occurred at least once every four hours (two-hour lag time from turbidity readings) during in-water work. Visual observations were recorded on the daily turbidity report. If the environmental monitor observed turbidity at levels that were estimated to be approaching the turbidity action level, a turbidity measurement was taken. If the initial readings indicated that the turbidity level was above the turbidity action level criteria the environmental monitor followed the procedures described above.

As prescribed in the biological opinion, the turbidity meter was calibrated twice daily as long as in-water work continued. One calibration was made prior to daily monitoring, and one upon completion of daily monitoring. The results of calibration were recorded in the Daily Turbidity Report.

Daily turbidity measurements, including information identifying all sampling locations and times, and calibration information, were emailed to NOAA Fisheries and the DEQ Project Manager.

During construction, the environmental monitor monitored erosion/pollution controls daily or more often as necessary to ensure that erosion and pollution controls were working adequately. Stormwater erosion control devices were inspected daily during rain events and weekly during the dry periods until the site was permanently stabilized. If monitoring and inspection showed that any of the

erosion controls (stormwater or other) were ineffective, E & E informed the contractor and instructed them to modify, maintain, or install appropriate erosion control. Sediment/soil erosion control measures were judged ineffective if, as a result of construction activities within the riparian or upland areas, an observable plume was evident or any non-compliance with local, state, and federal pollution control laws were observed (air or water quality).

Results of all monitoring activities are presented in the environmental monitoring report (E & E 2005), submitted to NOAA Fisheries on January 7, 2005. The report also contains discussions on river stage monitoring, endangered species observations made during the RA, and includes copies of the daily environmental monitoring forms, daily turbidity reports and Photo-Documentation. A copy of the environmental monitoring report is included in Appendix I.

2.8 Health and Safety

Remtech, E & E, and DEQ were responsible for ensuring proper health and safety procedures were followed at the site during construction activities. All contractors and consultants performing work on the site developed and implemented their own site safety plans in accordance with the provisions of the Occupational Safety and Health Administration (OSHA) Standards (29 Code of Federal Regulations [CFR] 1910) and General Construction Standards (29 CFR 1926), including OSHA Hazardous Waste Operations and Emergency Response, Interim Final Rule (29 CFR 1910.120). Compliance with all other applicable federal, state, and local laws and regulations was also required.

A formal safety meeting was held at the beginning of the project to review safety procedures with all site personnel and inform workers of potential hazards. Remtech and CanAm conducted daily safety meetings each morning before work began to discuss physical and chemical hazards associated with the day's activities. Site-safety briefings were also conducted for all new personnel reporting to the site and for all visitors to the site.

Protective clothing, such as a hard hat, steel-toed boots, safety vests, and safety glasses, were required for entry into the site's work zones (exclusion zone). The primary physical hazards at the site included heavy equipment operation on land and in water, noise, slips, trips, and falls. There was potential for contact with contaminants during in-water sediment cap material placement activities in highly contaminated areas (e.g., NAPL seeps and hot-spot area), demolition of bulkhead/dock remnant, and removal of treated pilings and dolphins. The major concern was with inhalation of vapors or contaminated particulates (i.e., dust), but there was also the potential for dermal contact and/or ingestion of contaminated matter. Remtech occasionally performed air quality monitoring during the RA. Airborne contaminant concentrations never exceeded action levels according to Remtech's air quality monitoring personnel, however several instances of increased vapor scent concerned field staff. During deep-water sand placement, a highly contaminated area was disturbed causing a strong vapor release. Field staff

requested respirators but upon arrival they were no longer needed. A similar event occurred while placing sand in shallow water; this resulted in work stoppage while the vapor dissipated. During dry conditions, Remtech controlled dust by water application with a water truck to help prevent on-site personnel and the public from being exposed to airborne contamination. However, a significant amount of dust was still generated during certain operations.

Overall, work was conducted safely at the site during the RA. Only one minor injury was reported during the RA implementation. A diver incurred a laceration on the thumb while cutting a pile underwater. He was taken to the hospital, treated and released. Two other safety concerns were noted involving heavy equipment; one accident occurred when a loader tipped over while attempting to load sand from a stockpile. The second occurred when the Volvo A35C Dump Truck was driven with the box up, which resulted with the box entangling a power line that came to rest on top of the truck. Portland General Electric was called to the scene. No injuries occurred during these accidents.

2.9 Documentation

2.9.1 Logbooks

Every member of E & E's field personnel was required to keep a daily logbook. A typical logbook entry consisted of the date, weather, details of construction, work completed, and various notes about the day's activities. At the end of each daily entry, the individual signed and dated his/her logbook to signify that he/she was done with the entry for the day.

2.9.2 Weekly Meetings

Each week a meeting was held that included Remtech, DEQ, and E & E. The purpose of the meeting was to discuss the progress of the project, to look ahead to future activities, and to resolve concerns brought to the table by any of the parties. Prior to the meeting, DEQ and E & E met to develop a list of points to be addressed. Midway during the project, a construction management consultant, Pinnell Busch, was brought on board to assist Remtech in construction scheduling and to act as a moderator during the weekly meetings when heated discussions impeded resolution of critical issues. The minutes of the weekly meetings are included in Appendix J.

2.9.3 Photo Documentation

All E & E field personnel had access to on-site digital cameras and were encouraged to use them often. Any time a digital photo was taken, the individual who took the photo recorded the date, time, photo number, direction, and short description of the photo in his/her photo log. Selected photos are included in Appendix D.

2.9.4 Daily Field Report

At the conclusion of each workday, E & E field staff was required to fill out a daily field report. The daily field report summarized; the days weather, (sub)

contractors on site, major equipment used, work completed, notes/issues, any safety concerns or nonconformances and who was notified. Each member of the E & E field staff compiled his/her own individual report, then one member of the field staff would make one master copy which was created from all the individuals.

2.9.5 Daily Turbidity Report

During all periods of in-water work, the E & E environmental monitor monitored the Willamette River for turbidity levels. The results of the monitoring were recorded by the environmental monitor in the daily turbidity report at the conclusion of each day of in-water work. The report contains the date, time of testing, location of testing, results of testing, results of calibration, and name of monitor. Copies of the report were sent to the DEQ Project Manager and NOAA Fisheries via email on a daily basis as in-water work persisted.

2.9.6 Daily Environmental Monitoring Form

E & E's environmental monitor completed a daily environmental monitoring form concluding each workday. The form contains information including; monitor's name, date, time, river stage observations, water quality observations (i.e., turbidity and sheen), movement of shoreline features, photo documentation, and perimeter walk details.

2.9.7 Employee and Visitor Log

An 'Employee and Visitor Log' was maintained by Remtech throughout the duration of the project. All personnel visiting or working at the site were required to sign the log and provide information including date, name, address, affiliation, purpose for visit, time in, and time out.

2.9.8 Aerial Photographs and Archaeological Monitoring

Aerial photographs of the project site as well as the topsoil excavation site were collected on a monthly basis. The primary intent of the photographs was to establish a time series record of the topsoil excavation relative to the stockpiling. This record could then be used in conjunction with periodic walkover surveys of the topsoil stockpile by AINW to establish a general location for archeological finds. In addition, the photographs documented the progression of sediment cap construction. Appendix K contains AINW's report, including the aerial photographs.

2.10 Community/Tribal Relations

The McCormick & Baxter site is situated in close proximity to a residential neighborhood and receives substantial public and media attention because of its listing on the National Priorities List. The site was also found to contain a derelict barge (subsection 2.3.2.4), which was recommended eligible for listing in the National Register of Historic Places. The following subsections describe activities employed by DEQ to maintain a proactive approach to community relations prior to and during construction of the sediment cap.

2.10.1 Public Outreach and Town Meetings

Prior to and during construction, DEQ representatives attended public meetings and distributed fact sheets to the local community (e.g., neighborhood associations). DEQ and the community were able to exchange information/concerns and answer questions. This approach enabled construction to proceed with support of the local community and avoid conflicts that could potentially slow or stop construction.

Prior to sediment cap construction, the DEQ Project Manager attended meetings with:

- North Portland Neighborhood Association – February 2, 2004 (Chairs Meeting)
- University Park Neighborhood Association – March 22, 2004
- St. John's Neighborhood Association – April 12, 2004
- Portland Harbor Community Advisory Group – June 9, 2004

During construction two more such meetings took place:

- St John's Neighborhood Association – September 13, 2004
- Portland Harbor Superfund Field Day – September 18, 2004

2.10.2 Press Releases

Prior to construction of the sediment cap DEQ published two press releases. One on April 15, and the other on July 1, 2005. These press releases informed the public about what was going to occur, who was going to do it, and how much it would cost. These press releases are included as Appendix L of this report.

2.10.3 Derelict Barge

Attached in Appendix E is the AINW Historical Assessment of the Wooden Barge that is documented within an Oregon Inventory of Historic Properties Section 106 Documentation Form. The assessment found that the barge was recommended eligible for listing in the National Register of Historic Places under Criterion C for its local significance.

2.11 Post-Construction Monitoring

A monitoring and maintenance plan was drafted in June 2003 (E & E 2003b). It was developed under certain assumptions that are expected to be modified as remedial actions at the site near completion and a site-wide Operation and Maintenance (O&M) Plan is developed by DEQ.

The premise of the monitoring and maintenance plan was to perform annual monitoring for the first three years to confirm that the sediment cap was stable and performing as designed. The frequency of monitoring was to taper off to every five years unless a significant natural event occurred. The natural events

included a 100-year flood event or greater, a 4.5-magnitude or greater earthquake, or storm events that caused significant debris to be carried by the Willamette.

Two tiers of monitoring were proposed. Outcomes to Tier 1 monitoring could lead to the more intensive investigations under Tier 2. For example, if a visual inspection shows a breach in the armoring (Tier 1), an evaluation as to the cause(s) and repair of the armoring is predicated (Tier 2). If the event is expected to occur frequently, Tier 2 also recommends that a plan to mitigate against the event should be formulated. The Tier 1 actions include inspection of the armoring, sand overlay, and the regraded bank; determining if sediment is being deposited on or within the armoring or whether a benthic community is establishing itself on the cap; sampling the capped seep areas for contamination; and performing bathymetric surveys to compare to historical surveys to determine if changes have occurred. Besides armoring repair as cited above, Tier 2 activities include additional sampling to determine future, if any, courses of action.

2.12 Unresolved Issues and Follow-On Activities

2.12.1 Sewer Lines and Completion of the Cap Installation

As noted in subsection 2.5, a no-work zone was established around the sewer lines within the river. The sediment cap construction will not be complete until this area has been capped. Completion of the cap must follow the repair of the exposed sewer line area by the City of Portland. (This work was completed in the August of 2005.)

2.12.2 Armoring of Steep Slopes

Also as mentioned in subsection 2.5, steeper and longer than expected underwater features were encountered during construction. Multiple solution scenarios were examined, and the only cost effective solution was to install extra sand and subsequent armoring per the design. The ultimate stability of the slope is dependent on many factors that are not quantifiable such as the stability of the piling wall that created the feature and the bearing capacity of the underlying sediments at the ridge. Therefore, as a follow-on activity, periodic monitoring of the slope by visual dive inspections is recommended. The recommended frequency is at least one annual inspection after the spring high-water run-off.

2.12.3 Cable Loops

E & E and DEQ identified a possible public health hazard associated with ACB cable loops, and directed the Contractor to cut them. One end of each mat has exposed cables as a result of the installation sequence. Typically, there are eight loops of cable that make up four lifting eyes on each mat end. The Contractor's progress both on the shore and in the water was slow and as a time and materials task the cost was becoming inappropriately high. Therefore, E & E and DEQ halted the cutting operations at which time approximately half of all the loops were cut. E & E and DEQ secured another contractor for completion of the loop cutting on the shoreline with a more appropriate and cost effective cutting

method. The loops within the river that are not accessible during low tide still remain, but the loops will be cut either during a low-water period or by divers.

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Table 2-1

COMMONLY USED EQUIPMENT SPECIFICATIONS
SEDIMENT CAP CONSTRUCTION
MCCORMICK & BAXTER CREOSOTING COMPANY SITE
PORTLAND, OREGON

Equipment	Refferd to as:	Specifications
Excavators		
Caterpillar 426 Backhoe	Backhoe	1.25 cu yds Loader bucket capacity; Arm length: 5' 6"
Case 4060b Trackhoe	Excavator	
Kobelco 200 SLRC Trackhoe	Excavator	Operating weight: 22 metric tons; 0.88 - 1.25 cu yds bucket capacity; Arm length: 9' 10"
Caterpillar 320c Trackhoe	Excavator	Operating weight: 21.001 metric tons; 0.62-1.75 cu yds bucket capacity; Arm length: 9' 7"
Caterpillar 322b Trackhoe	Excavator	Operating weight: 24.313 metric tons; 0.63-2.5 cu yds bucket capacity; Arm length: 9' 8"
Caterpillar 325b Trackhoe	Excavator	Operating weight: 28.6 metric tons; 0.88-3.00 cu yds bucket capacity; Arm length: 23' 3"
Komatsu PC200 Long Reach Trackhoe	Long-reach Excavator	Operating weight: 55,000 lbs; Arm length: 50'
Loaders		
Caterpillar 950 Wheeled Front-End Loader	Loader	Operating weight: 40,853 lbs; 183 Horse Power; 3.53 cu yrd bucket;
Haulers/Dump Trucks		
Ford LTL 9000 Dump Truck	Ford dump truck	9 cu yds capacity
Kenworth Dump Truck	Kenworth dump truck	10 cu yds capacity
Taylor Side-Dump Truck	Side dump (truck)	16 cu yds capacity
International Dump Truck	International dump truck	8.5 cu yds capacity
Volvo A35C Articulated Hauler	A35C	71,650 lb Payload Capacity; 26.2 cu yds heaped capacity; Empty machine weight: 62,391 lbs.; 382 Net Horsepower
Bulldozers		
Caterpillar D7 Bulldozer	Bulldozer	Operating weight: 54,985 lbs; 8.98 cu yds blade capacity
Caterpillar D6 Low-Ground-Pressure Bulldozer	LGP Bulldozer	Operating weight: 39,070 lbs; 34" track width; 4.13 cu yds blade capacity
John Deere 5506Lt Bulldozer	Bulldozer	Operating weight: 17,016 lbs; 18" track width; 2.11 cu yds blade capacity
Other		
Campbell Crane HC-248H	Crane	200 ton capacity
Hyster 360 Fork-Lift	Fork-lift	
International Box-Van	Van	
Freightliner FL70 Water Truck	Water truck	3500 gal. Tank capacity
Vermeer Chipper	Chipper	

Table 2-2

UPLAND AREA WELL SUMMARY
SEDIMENT CAP CONSTRUCTION
MCCORMICK & BAXTER CREOSOTING COMPNAY SITE
PORTLAND, OREGON

Well ID	Action
MW-35r	New
MW-59s	New
B-60d	New
EW-5s	Abandon
EW-12s	Abandon
EW-14s	Abandon
EW-16s	Abandon
EW-17s	Abandon
EW-22s	Abandon
EW-25s	Abandon
MW-5s	Abandon
MW-10s	Abandon
MW-11s	Abandon
MW-14s	Abandon
MW-22i	Abandon
MW-33s	Abandon
MW-35s	Abandon
MW-Es	Abandon
MW-Is	Abandon
MW-Js	Abandon
MW-Ni	Abandon
MW-Rs	Abandon
EW-1s	Repair
EW-2s	Repair
EW-9s	Repair
EW-18s	Repair
MW-1s	Repair
MW-2s	Repair
MW-3s	Repair
MW-15s	Repair
MW-18s	Repair
MW-20i	Repair
MW-23d	Repair
MW-32i	Repair
MW-48s	Repair
MW-49s	Repair
MW-50s	Repair
MW-51s	Repair
MW-52s	Repair
MW-53s	Repair
MW-54s	Repair
MW-55s	Repair
MW-56s	Repair
MW-57s	Repair
MW-As	Repair
MW-Cs	Repair
MW-Ds	Repair
MW-Gs	Repair
MW-Ks	Repair
MW-Os	Repair
PW-1d	Repair
PW-2d	Repair
EW-10s	Repair if impacted by soil cap
EW-19s	Repair if impacted by soil cap
MW-34i	Repair if impacted by soil cap
NEW WELLS	
MW-58s	Retain
MW-58i	Retain
MW-58d	Retain

Table 2-3

SEED MIXTURE
SEDIMENT CAP CONSTRUCTION
MCCORMICK & BAXTER CREOSOTING COMPANY SITE
PORTLAND, OREGON

Herbaceous species	Common Name	% Live Seeding Rate/Acre	Plant Type
Bromus carinatus	California brome	17	Seed
	Sterile wheatgrass	15	Seed
Elymus glaucus	Blue wildrye	14	Seed
Hordeum brachyantherum	Meadow barley	6	Seed
Deschampsia elongata	Slender hairgrass	3	Seed
Agrostis exerata	Spike bentgrass	2	Seed
Gilia capitata	Globe gilia	3	Seed
Lupinus albicaulis	Lupine	6	Seed
Solidago canadensis	Canada goldenrod	0.25	Seed

Table 2-4

HYDROSEED MULCH MATRIX MIXTURE
SEDIMENT CAP CONSTRUCTION
MCCORMICK & BAXTER CREOSOTING COMPANY SITE
PORTLAND, OREGON

Component	Bags per Load	Pounds per Load	Pounds Per Bag
Mulch	20	1000	50
Fertilizer	6	300	50
Native Seed Mix	1.5	75	50
Sterile Wheat Grass	6-Jan	8	50
Tackifier	2-Jan	30	60
Lime	1	2.5 Gallons	

Table 2-5
Sediment Cap Construction
Summary of Change Orders
McCormick & Baxter Site
Portland, Oregon

Reason	Resulting Change(s)
Change Order 1 dated 7 April 2004: Post-construction barrier wall monitoring results led to the concern that high groundwater levels within the barrier wall enclosure could potentially overtop the wall.	1. The requirement to cut the sheet pile wall to the ordinary high water elevation was deleted. Only that sheet pile that extended higher than the surrounding wall needed to be cut to match adjacent wall elevations. 2. The shoreline slope was steepened as it approached the wall to provide adequate cover at the wall. 3. The ACB design was modified to account for this steeper approach. Contract quantities and costs were adjusted for the changes. The number of days to complete the job remained unchanged.
Change Order 2 dated 5 May 2004: Based on Remtech's submittals, the design elements were modified or refined including organoclay placement, truck routes, and approach to fish exclusion. In addition, ongoing design of the upland cap led to modification of the final fence alignment and topsoil compaction requirements.	1. Remtech selected Aqua Technologies, Inc.'s product, which was pelletized, alleviating concerns about organoclay porosity. Thus, instead of mixing with sand, Remetech was allowed to place the product in a single pure layer. In addition, the tolerance was changed from +10% to +/-5%. 2. Limited use of N. Van Houton Pl. by trucks was allowed. 3. Remtech lacked the expertise to develop fish exclusion measures as evidenced by their submittal. An E & E subcontractor was tasked with writing a contingency plan for inclusion into Remtech's COP. Remtech's approval of the plan was required before submittal to NOAA as required by the BO and Remtech was to pay for the costs of implementation. 4. The fence location was modified to eliminate relocation during upland cap construction. 5. Compaction of the top two feet of topsoil was not allowed except as resulted from equipment traffic. Contract quantities and costs were adjusted for the changes. The number of days to complete the job remained unchanged.
Change Order 3 dated 17 May 2004: For construction planning purposes, it was desirable to accelerate the timing of the pre-construction bathymetric survey in order to determine the actual bathymetry and to delineate possible debris fields.	Restrictions for the timing of the pre-construction bathymetric survey were lifted and the expectations for the final product were reiterated. This change order did not result in any change to the contract cost or the number of days to complete the job.

Table 2-5
Sediment Cap Construction
Summary of Change Orders
McCormick & Baxter Site
Portland, Oregon

Reason	Resulting Change(s)
Change Order 4 dated 9 June 2004: Ongoing upland cap design led to modification of the demarcation layer. Remtech requested that they be allowed to conduct limited mobilization in advance of their indicated construction start date.	1. To enable plant roots to penetrate the demarcation layer and to be visible during future construction, an orange safety fencing product was specified. Use of a demarcation layer under spoils stockpiles was eliminated. 2. In order to start in-water work on July 1, limited mobilization was allowed. Activities were restricted to establishing a construction trailer, installing fencing at the Willamette Cove staging area, and erecting a crane. This change order did not result in any change to the contract cost or the number of days to complete the job.
Change Order 5 dated 7 July 2004: To facilitate construction of the upland soil cap in 2005, opportunities to import and stockpile topsoil under the sediment cap contract were evaluated. DEQ decided that importing topsoil under this contract would be beneficial.	1. The sediment cap fill/topsoil requirements were modified to match those of the proposed import material. 2. Stockpile preparation and execution were detailed including a discussion of haul routes, hazardous material management, and environmental protections. 3. Method of payment and oversight monitoring procedures were described. Contract quantities and costs were adjusted for the changes. The number of days to complete the job remained unchanged.
Change Order 6 dated 22 September 2004: Remtech claimed that increased costs and delays were due to site conditions that were beyond their control. Although E&E and DEQ did not necessarily agree, the issue threatened to sidetrack the project. This change order was issued to defuse the blame issue and to pay for Remtech's claim of specified additional costs up to the point of issuance. This change order also addressed modifications to the design to address actual site conditions.	1. DEQ agreed to pay for all sand placed to date. Tolerances were provided for future sand placement. 2. DEQ agreed to pay for underwater investigation of debris and steep slopes. 3. DEQ agreed to pay for underwater debris removal and disposal. 4. DEQ agreed to pay for standby charges to date. 5. ACB mat was eliminated in areas that were logistically complicated and replaced with rock armoring. 6. One seep area was eliminated and organoclay placement at the remaining two seeps were modified. 7. DEQ allowed Remtech to dispose of non-hazardous waste in onsite pits and requested that a test pit be excavated in Willamette Cove to better delineate a new seep area. Contract quantities, costs, and days to complete the work were adjusted for the changes.

Table 2-5
Sediment Cap Construction
Summary of Change Orders
McCormick & Baxter Site
Portland, Oregon

Reason	Resulting Change(s)
Change Order 7 dated 22 September 2004: DEQ made a further attempt to neutralize all confrontational issues to date with this change order. Remtech requested that they replace their subcontractor in the role of marine contractor.	1. DEQ agreed to pay Remtech to forever release DEQ and all associated entities from past and present claims while recognizing the unforeseen site conditions might still impact the work. The on-site working days were increased and Saturday work was approved. 2. Remtech agreed to pay DEQ for the right to have Keith Carpenter be named as the marine superintendent for the duration of the work. Contract quantities, costs, and days to complete the work were adjusted.
Change Order 8 dated 20 October 2004: This change order was issued to formalize and detail verbal and written agreements between DEQ and Remtech to date and to address project completion items.	1. Material quantities and payment were increased or decreased for numerous items including Saturday work, geotextile underlayment, sediment cap repairs, and individual cap components. 2. Approved activities associated with termination of the project included creating an ACB mat storage area, cutting the ACB cable loops, and deleting the need for a final Edgewater Street pavement survey. Contract quantities, costs, and days to complete the work were adjusted.
Change Order 9 dated 3 November 2004: An agreement between DEQ and Metro was forged to address the seep discovered in Willamette Cove. This change order addressed that work. It also further addressed modifications to quantities and costs of materials.	1. Remtech was tasked with doing work in Willamette Cove at a new seep area in accordance with a scope of work that had been developed for the activity. 2. Material quantities and payment were increased or decreased for numerous cap components. 3. Installation of the permanent fence running along the riverward side of the site was eliminated. Contract quantities and costs were adjusted for the changes. The number of days to complete the job remained unchanged.
Change Order 10 dated 22 November 2004: This change order addressed additional modifications to quantities and costs of materials. To speed up project completion, the vegetation portion of the contract was eliminated and subcontracted out separately.	1. Quantities and payment were increased for the TRM and waste disposal activities. 2. The vegetation requirements of the contract were deleted. Contract quantities and costs were adjusted for the changes. The number of days to complete the job remained unchanged.

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Table 2-6

SUMMARY OF MEMOS AND FIELD DIRECTIVES
SEDIMENT CAP CONSTRUCTION
MCCORMICK AND BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Date	Description		Deviation to Scope of Contract	Corrective Action
08/16/04	Select Backfill Material	E & E expressed concern that the first barge load of topsoil had excessive amounts of cobble.	Specification for topsoil presented in Change Order #5.	The Contractor had his supplier screen out cobbles.
08/19/04	Working Easement for Pressurized Sewerlines	Discovery that the sewerlines in the river were exposed and not buried as expected.	The design was modified, and specified material for the Cap were not installed within the easement.	The Contractor informed his subcontractors and personnel about the working easement ('No Work Zone'). Installation of the Cap in the easement will be addressed as follow-on work and covered under a separate contract.
08/20/04	Notice of Non-conformance: Bank Regrade and ACB Interface.	The Contractor did not construct the Bank Regrade per Design Drawings and Specifications.	Not Applicable	The Contractor corrected the non-conformance.
08/25/04	Toe Treatment Design for Mat Elimination Areas	Elimination of the requirements to install ACB in certain areas due to steep slopes and the working easement around the sewerlines resulted In the need for an alternative edge treatment for the ACB.	Deviations to the contract were addressed in Change Order #6, Item 5 and Change Order #8, Item 22.	This Toe Treatment design was further modified in subsequent Field Directives.
08/30/04	Map Showing Area of Debris Survey by Divers	Transfer of information regarding the area for a visual dive survey that was performed by Remtech subcontracted divers.	Deviations addressed in Change Order #6, Item 2.	Not Applicable
09/02/04	Revision to Grading, Southern Bank Regrade	Minimization of imported fill required to implement the Bank Regrade.	Deviations to the contract were addressed in Change Order #8, Item 2.	Fill requirements were minimized.
EERT #	**Description**	**Reason**	**Deviation to Scope of Contract**	**Corrective Action**
1	Request for prior notification by the contractor of mat grouting activities.	Required for adequate time to schedule fish exclusion.	Not Applicable	Notification was given. However, fish exclusion was not required by DEQ.
2	ACB alignment error in Area 1 and request for written description on Corrective Action Plan.	QA inspection identified an error in alignment and installation of ACB. Remtech acknowledge error.	Not Applicable	Remtech installed additional ACB.
3	T&M daily sign-off.	Discrepancies in T&M tracked by E & E and submitted by Remtech.	Not Applicable	E & E inspectors and Remtech's QCI sign daily tracking forms.
4	Disposal of Jute Mat	Cost savings to the State for on-site disposal of Jute Mat.	A credit proposal for Option A Bid Item A.2 was submitted and a later revision to the contract was addressed in Change Order #6, Item number 10.	The Jute Mat was disposed on-site and a credit was given to the State.
5	Area 1 ACB mat alignment error drawings	Same as EERT-1	Not Applicable	Same as EERT-1
6	Bank Regrade in Area 7 Modification Not Needed	The proposed area 7 change to move the landward edge of ACB and eliminate the need for fill was negated by contractor activities.	Not Applicable	This EERT was rescinded as it was necessary to change ACB edge and obtain more fill from cut.
7	Cut Loops on ACB mats	Directive by E & E and DEQ to cut loops on shoreline not over sewer lines or in organoclay areas, and to submit proposal for in-water loops.	The loop cutting operations will be on a T&M basis. This deviation was formalized in a change order.	Remtech began loop cutting on the shoreline and submitted a proposal for in-water cutting.
8	Not issued	Not issued.	Not issued.	Not issued.
9	Not issued	Not issued.	Not issued.	Not issued.
10	Importation of rock (Sediment Cap construction material) via truck	Remtech requests permission to import rock by truck and stockpile on Ziddell property.	Not Applicable	Remtech transported rock.

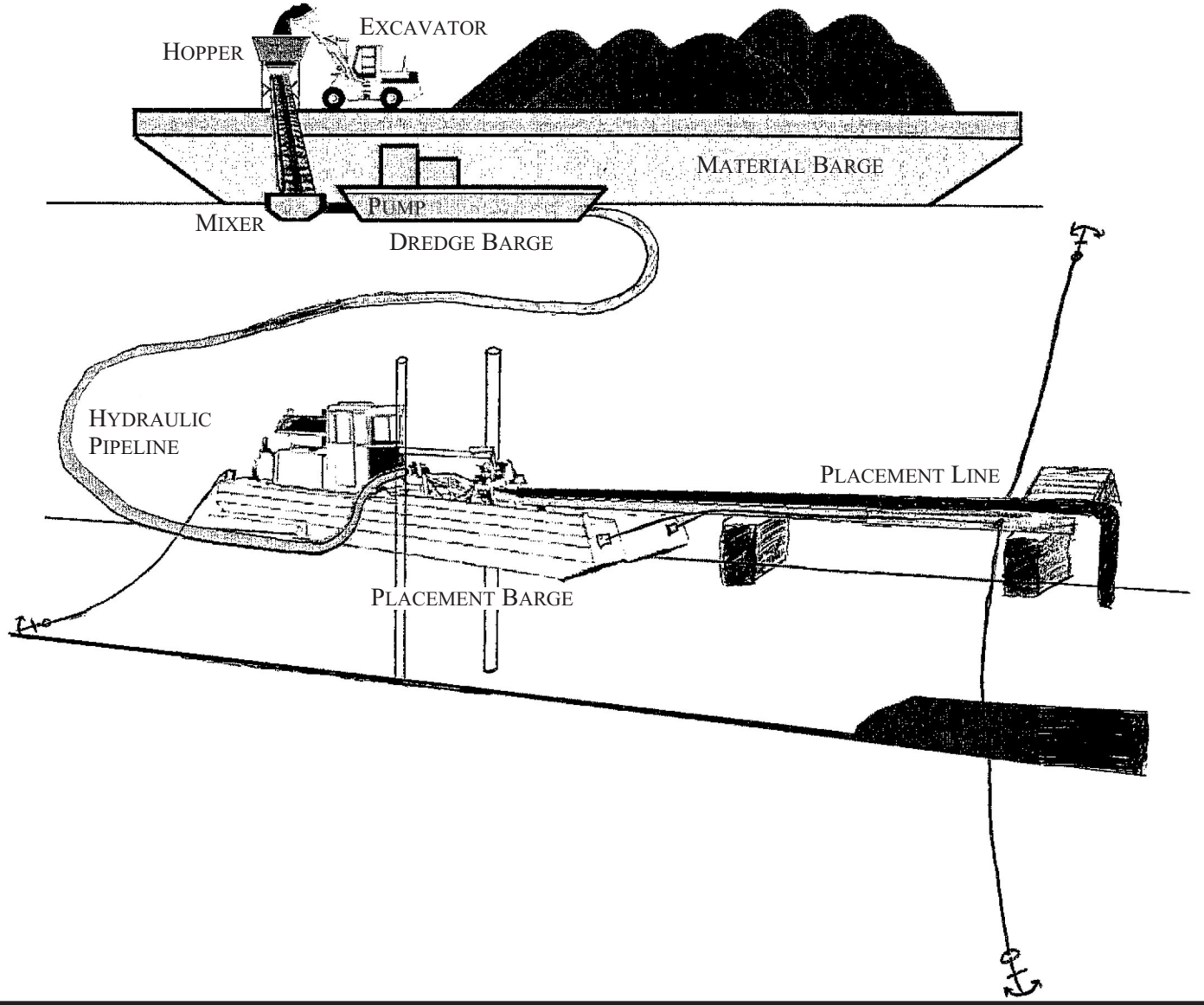
11	Sand Overlay in Willamette Cove	E & E and DEQ request a plan for placement of sand overlay by windrow method from Remtech.	Windrow placement is not even distribution of sand over ACB surface. No cost change.	Sand was placed by windrow method
12	Area 7 Band Regrade	Fill required to complete bank grading. E & E and DEQ modified Area 7 design to allow contractor a borrow area.	Multiple cost and schedule impacts that were addressed in Change Orders.	Area 7 design was modified, ACB placement modified, and Area 7 borrow area used.
13	Draft cross-sections of steep area in Area 7.	Remtech requested a plan view and cross-sections for Area 7 modifications.	Multiple cost and schedule impacts that were addressed in Change Orders.	Area 7 design was modified, ACB placement modified, and Area 7 borrow area used.
14	Construction road to facilitate 10-inch minus placement.	Permission to construct a temporary construction road for 10-minus rock placement along the riverward edge of ACB.	Additional Costs addressed in Change Order #8, Item number 3.	Road was constructed and used.
15	Response to Loop Cutting Memo.	Sequence of loop cutting correction to Remtech regarding when E & E was informed of cutting loops over organoclay seep area.	Not Applicable	Remtech stopped loop cutting over organoclay area.
16	Reissue of ACB Area 1 error in Mat Placement	The third issue of misalignment of ACB mats in Area 1 as requested by Remtech. Related directives are EERT-02 and EERT-05.	Not Applicable	Not Applicable
17	Remtech request for subgrade elevation verification.	Remtech requested sub-grade elevation verification. E & E is does not perform subgrade elevation verification (surveyor's responsibility), but will verify thickness of topsoil.	Not Applicable	Not Applicable
18	Response to Remtech regarding fence line at edge of Greenway Limits.	Remtech was not clear on Greenway Limits and fence line requirements.	Not Applicable	Not Applicable
19	Elevation of Subgrade	Remtech requested verification of subgrade in ACB Area 7.	Addressed in Change Orders #6, Item number 9 and Change Order #8, Item 22.	Not Applicable
19a	Revision of EERT-19 by Kevin Parrett and Keith Carpenter.	Area 7, Remtech requested verification of subgrade.	Addressed in Change Order.	Not Applicable
20	Area 7 Steep Slope	Directive to fill steep area off ACB Area 7.	Additional compensation for filling steep area addressed in Change Order #8, Item 23.	The steep area was filled with rock and sand.
21	The Seep Area Identified by Munitor and Remtech.	Remtech not to stop work in area where sediments appear to be extruding.	Not Applicable	Not Applicable
22	Comparison of QA Coring to Bathymetry.	Remtech requests a copy of Bathymetric survey performed by E & E subcontractor and compared to coring data.	Not Applicable	Not Applicable
23	Cutting Loops	Direction on loop cutting in sewer line area and use of pelican hooks between blocks for future lifting.	Not Applicable	Not Applicable
24	ACB Edge Details, Area 1 and 2.	Edge detail in area 1 and 2 clarification from Alexander Whitman to Remtech.	Not Applicable	Not Applicable
25	Thickness of Sand and Placement of Armoring.	Directive to proceed with armoring in all areas downstream of ACB Station 22 + 50.	Not Applicable	Not Applicable
26	Sand Overlay, Willamette Cove.	E & E acceptance of Remtech's plan for Sand Overlayment placement in Willamette Cove.	Not Applicable	Not Applicable
27	E & E Senior field person on Saturday September 18, 2004.	E&E informs Remtech of senior onsite representative for Saturday September 18th.	Not Applicable	Not Applicable
28	Not used	Not used.	Not used.	Not used.
29	Area 7 Mat Layout	ACB Mat design layout changes to Remtech.	Impacts of design changes were addressed in Change Orders.	Not Applicable
30	Remtech to Proceed with Loop Cutting	Remtech proves ACB lifting technique and was directed to cut remaining ACB loops	Remtech was given approval to cut all loops including those over the Sewer lines and Seep areas. The cost associated with loop cutting were addressed in Change Order #8, Item number 24.	Not Applicable
31	No Fish Exclusion during out of water grouting.	Remtech is informed by E&E that no fish exclusion shall be preformed during out of water grouting.	Not Applicable	Not Applicable

32	QA Verification of 6-inch Minus.	E & E submits the QA verification procedure to Remtech.	Not Applicable	Not Applicable
33	Modification to paragraph on EERT-26.	E&E and DEQ request that Remtech allow an inspect temporary access road in order to ensure that ACB is not damage by construction vehicles.	Not Applicable	Not Applicable
34	ACB Edge Treatment Detail, Areas 1 and 2, Additional Information.	Additional information to Remtech for ACB/riprap interface and quantity estimate for 10-inch minus required.	Additional quantities of 10-minus rock were addressed in Change Order #8, Item 6.	Approximately 246-feet of 10-inch minus edge treatment was installed at the ACB/riprap interface along the BNRR easement in Willamette Cove.
35	Revised ACB Layout for Area 7 including new stationing.	Additional information regarding station locations for ACB Area 7 layout revision.	The deviations to the scope of the contract were addressed in Change Order #8, Item number 22.	
36	Maps generated during inspection ACB, areas that require grouting.	Delivery of the out of water grouting area maps to Remtech.	Not Applicable	Not Applicable
37	Comparison of existing and new stationing points.	Presentation of Comparison of station points.	Not Applicable	Not Applicable
38	Grout Mix	Acceptance of the grout mix provided by Remtech.	Not Applicable	Not Applicable
39	Maximum height of topsoil stockpile.	Directive to Remtech regarding the maximum allowable height of the topsoil stockpile.	Not Applicable	Not Applicable
40	Excavation of extruded material and debris.	Formalization of direction to Remtech by DEQ.	Additional compensation for performing the repairs was addressed in Change Order #8, Item 4 and 13.	The areas were repaired.
41	6-inch minus rock placement in grid section 22 and 25.	Clarification to Remtech regarding the steep slope modifications and affect on rock placement at the ACB/6-inch minus interface.	Not Applicable	Not Applicable
42	Edge Detail for ACB sewer area.	Direction given to Remtech regarding the edge treatment near sewer lines.	Deviations addressed by Change Order #8 Items number 22.	Edge treatment between ACB and sewerline no work zone was constructed with 6-inch minus rock.
43	Response to Remtech email regarding Edge Detail for sewer line area.	Statement of feasibility of EERT-42.	Not Applicable	Not Applicable
44	Additional information regarding Edge Detail in sewer line area.	Revision of details to edge treatment near sewer easement.	Not Applicable	Not Applicable
45	E & E Senior field representative, Saturday September 25.	E&E informs Remtech of senior onsite representative for Saturday September 25th.	Not Applicable	Not Applicable
46	Sewer line area with no edge treatment.	The edge treatment of ACB directly up gradient from the exposed sewerlines was eliminated due to DEQ concerns.	Not Applicable	Not Applicable
47	Rock mound changes.	Remtech was directed to replace portions of the Riprap mound with 10-inch minus rock.	The contract deviations due to this directive were addressed in Change Order #8, Items 6 and 17.	Rock mound was constructed mostly with 10-inch minus.
48	Remtech directed to attempt an alternative loop cutting method.	The loop cutting method employed by Remtech appeared to be too time consuming and was considered too costly by DEQ.	Measure and payment for loop cutting was addressed in Change Order #8, Item number 24.	Remtech stopped cutting loops.
49	Well abandonment and modification plan.	Monitoring well not identified in the contract were affected by bank regrade.	Deviations addressed by Change Order #8 Items number 11 and 12.	Remtech directed the drilling subcontractor.
50	10-inch minus rock mound design.	Follow up to EE-RT-47	The contract deviations due to this directive were addressed in Change Order #8, Items 6 and 17.	Rock mound was constructed mostly with 10-inch minus.
51	ACB mat storage pad.	Request for cost estimate to construct a storage pad.	Not Applicable	Not Applicable
52	Well Abandonment and Modification Costs.	E & E identified that unit costs requested in EE-RT-49 were covered under unit costs in existing contract.	Not Applicable	Not Applicable

53	Eliminate steep slope modification from SOW.	Elimination of requirements to flatten slopes steeper than 2.5H: 1V.		
54	Gap in ACB cabling in ACB.	Field inspectors found an area where ACB blocks were not cabled together.	Not Applicable	Remtech cabled blocks together.
55	Upland grading south of BNRR, additional direction.	Slight change in SOW for grading and construction of an access road adjacent to the North end of ACB.	Additional compensation for changes associated with this directive were addressed in Change Order #8, Item number 19.	Remtech made changes and constructed an access road.
56	Eliminate 6-inch minus on west side of RR pier.	Elimination of requirement to place 6-inch minus adjacent to the RR pier. Direction to place 10-inch minus and riprap per design.	Not Applicable	Not Applicable
57	Substitute 10-inch minus for 6-inch minus edge treatment.	E & E and DEQ allow substitution of 10-inch minus for 6-inch minus edge treatment.	Not Applicable	Not Applicable
58	Armoring under BNRR bridge abutment.	E & E and DEQ considered the size and thickness of the riprap at the BNRR bridge abutment to be adequate and no additional placement was necessary.	Not Applicable	Not Applicable
59	Windrow placement of sand overlay for 10-inch minus armoring area.	Remtech submitted a proposal to place sand in windrows at a reduce rate.	The deviations to the contract due to this directive were addressed in Change Order #8, Item numbers 14,18, and 21.	Sand was placed by windrow method
60	ACB mat storage area, acceptance of cost estimate.	Changes to the ACB mat layout due to differing site conditions resulted in ACB mats that were not utilized.	The deviations to the contract due to this directive were addressed in Change Order #8, Item number 1.	An ACB mat storage area was constructed.
61	E & E Senior field representative on Saturday October 2.	E&E informs Remtech of senior onsite representative for Saturday October 2nd.	Not Applicable	Not Applicable
62	Upland grading south of BNRR, additional direction.	Additional directions for EE-RT-55	Not Applicable	Not Applicable
63	Deletion of some wells from Well Modification Plan.	EE-RT-49 listed wells to be modified or abandoned, due to upland grading modifications and allowance for an access road wells EW-19s and EW-10s did not require modification.	Deviations addressed by Change Order #8 Items number 11 and 12.	Remtech informed their well drilling contractor and the wells remained unmodified.
64	Hydroseeding.	Acceptance of hydroseeding sequence given by Remtech.	Not Applicable	Not Applicable
65	Additional Sand Cap in newly identified seep area.	Directive to place additional sand in the newly identified seep area	Deviations addressed in Change Order #8, Items 14 and 15.	Seep area was covered with additional sand.
66	E & E Senior representative for October 8.	E&E informs Remtech of senior onsite representative for Saturday October 8th.	Not Applicable	Not Applicable
67	ACB Area 7 grouting verification.	Grouting is acceptable in ACB area 7.	Not Applicable	Not Applicable
68	Additional Sand Cap at newly identified seep area.	Additional information for implementation of EE-RT-65.	Deviations addressed in Change Order #8, Items 14 and 15.	Seep area was covered with additional sand.
69	Repair to Cap.	Location and directions for necessary repairs.	Deviations addressed in Change Order #8, Items 4 and 13.	Repairs were completed.
70	Clarification to Remtech regarding additional Sand Cap at newly identified seep area.	Additional design information for the Additional Sand Cap at the newly identified seep area.	Deviations addressed in Change Order #8, Items 14 and 15.	Seep area was covered with additional sand.
71	Seep area repair and additional Sand Cap.	Additional design information for the Additional Sand Cap at the newly identified seep area.	Deviations addressed in Change Order #8, Items 14 and 15.	Seep area was covered with additional sand.
72	Blocking access road in W.C.	Directions for blocking the access road down to the beach in Willamette Cove.	Not Applicable	Not Applicable
73	TRM installation.	TRM installation procedure acceptance and request for more information from the Contractor.	Not Applicable	Not Applicable
74	E & E senior representative for 10/15-10/25.	E&E informs Remtech of senior onsite representative for Saturday October 25th.	Not Applicable	Not Applicable
75	Sand overlay in 10-inch minus armoring area addressed in Change Order 8.	Response to Remtech's request for information on windrow placement of Sand Overlay.	Deviations addressed in Change Order #8, Items 21 and attached drawing.	Sand Overlay was placed in windrows as directed.
76	Painting of extended well casings.	Directions for finishing the modified well casings.	Deviations addressed in Change Order #8, Items 11 and 12.	Well casings were modified.

77	Grading of bank barge demolition area.	Directions for restoring the barge demolition area of work.	Not Applicable	Not Applicable
78	ACB Area 1, Near RR embankment.	Directions for completing the installation of ACB/riprap edge in ACB Area 1 near the RR embankment.	Not Applicable	The edge treatment was installed per the directive.
79	Haul road over ACB.	The fate of the haul road over the ACB.	Not Applicable	The haul road was removed.
80	TRM Installation.	Additional directions for the installation of TRM	Not Applicable	Not Applicable
81	Davis-Bacon Audit interviews.	Transfer of information regarding a Davis-Bacon Wage Audit to Remtech.	Not Applicable	Not Applicable
82	TRM installation-revision to previous directives.	Directions for using power driven nails to secure the lower edge of the TRM to the ACB.	Not Applicable	Not Applicable
83	Deletion of fencing along Greenway Edge.	Removal of fence installation from the Contractor's SOW.	Deviations addressed in Change Order #9, Item number 5.	The fence was not installed.
84	Quantity of non-hazardous waste.	Due to the amount of Non-hazardous waste generated from the barge demolition, Remtech requests an increase to the contract amount for non-hazardous waste disposal.	Deviations addressed in Change Order #9, Item number 4.	Transportation and off-site disposal of specified material.
85	Quantity of 10-inch minus.	Remtech requests more 10-inch minus to complete cap placement near the embayment area.	Deviations addressed in Change Order #8, Item number 6.	Additional rock was purchased and installed.
86	Disposition of stockpiles and debris piles.	E&E directs Remtech on treatment of several stockpiles around site	Not Applicable	Not Applicable
87	Upgrade to nails and washers specified in EERT-82 for securing TRM to ACB.	Remtech requests an upgrade in nails for TRM/ACB transition from galvanized to stainless steel.	Deviations addressed in Change Order #9, Item number 6.	Remtech was unable to acquire and supply stainless steel nails and was not paid for the upgrade.
88	The last day of in-water work.	E&E informs Remtech of last day of in-water work (10/29/04)	Not Applicable	Not Applicable
89	In-water work completion.	Remtech requests verification that in-water work is complete	Not Applicable	Not Applicable
90	Increase in TRM quantity.	Based on initial analysis of the bank grading, the contracted amount of TRM is insufficient to complete the task.	Deviations addressed in Change Order #9, Item 2.	Additional TRM was delivered.
91	Tolerance of topsoil verification.	Remtech requests clarification on specifications and tolerance of 2' topsoil bank re-grade	Not Applicable	Not Applicable
92	Substitution of rectangular trench cross-section with vee-trench cross-section.	Remtech requests a change to the TRM anchor trench for ease and speed of construction.	Not Applicable	Remtech did not implement the acceptance of the substitution given in this directive.
93	Additional TRM.	Based on discussions with Remtech and field calculations, the contracted amount of TRM is insufficient to complete the task.	Deviations addressed in Change Order #10, Item 1.	Additional TRM was delivered.
94	Non-hazardous waste disposal.	Due to the amount of Non-hazardous waste generated from the barge demolition, Remtech requests an increase to the contract amount for non-hazardous waste disposal	The deviation to the contract due to the topic discussed in this directive were addressed in Change Order #9, Item number 4 and Change Order #10, Item number 2.	Transportation and off-site disposal of specified material.
95	Completed punchlist items.	E&E informs Remtech that all punchlist items have been completed.	Not Applicable	Not Applicable

Source: Remtech COP, June 2004.



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Portland, Oregon

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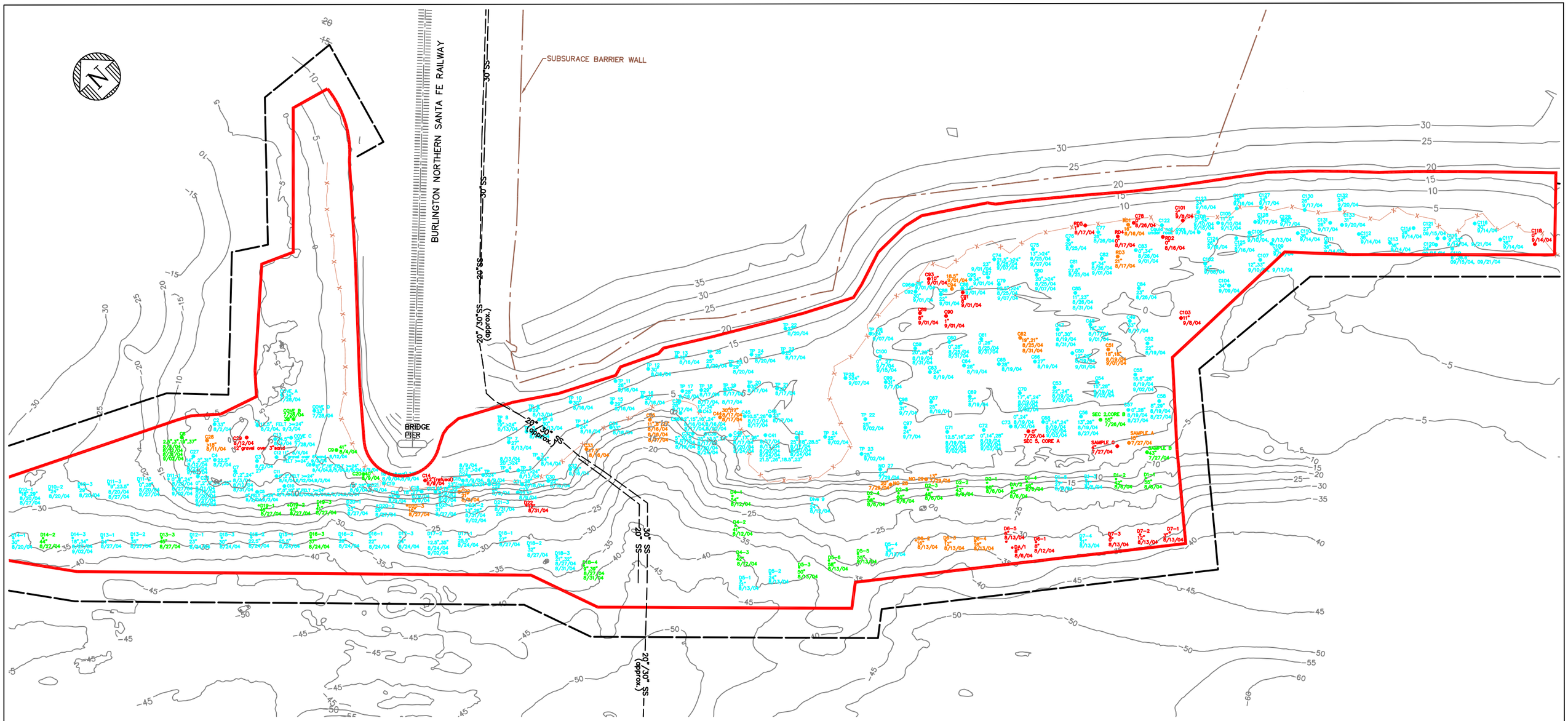
Portland, Oregon

Figure 2.1
REVERSE DREDGE OPERATIONS

Date:	Drawn by:	
2/25/05	AES	10:001688OY022902\fig 2.1



NOTES

1. DATES MAY INDICATE ONLY THE FINAL CORING AT A LOCATION. PREVIOUS CORING(S) AT A LOCATION MAY HAVE OCCURRED.

2. SOME SAND CORES MAY NOT REPRESENT FINAL SAND PLACEMENT. FOR EXAMPLE, CORE 101 WAS TAKEN ON 9/8/04 AND WAS DETERMINED TO HAVE A THICKNESS OF 2". ADDITIONAL SAND WAS PLACED IN THE AREA AND ADDITIONAL CORES WERE TAKEN, SUCH AS CORE 108 AND CORE 123, WHICH WERE TAKEN ON 9/16/04 AND WERE EACH DETERMINED TO HAVE A THICKNESS OF 24".

LEGEND

- DSL EASEMENT (#31530-EA)
- SAND CAP BOUNDARY
- SURVEY DATUM BOUNDARY (CRD/NGVD)
- HIGH PRESSURE SEWER LINE

CORING SAND THICKNESSES

RED: 0-12"
ORANGE: 13"-21"
CYAN: 22"-36"
GREEN: >36"

SCALE IN FEET: 0 80 160 240

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Portland, Oregon

DESIGNED BY:
CHECKED BY:
DRAWN BY: S. STEVENS
APPROVED BY

FIGURE 2-2

SAND CORING DATA AND LOCATIONS

McCORMICK & BAXTER CREOSOTING CO. PORTLAND, OREGON

SCALE: NOTED
DATE ISSUED: 5-24-06
C.A.D. FILE NO.: Sediment Cap CSR Figs.dwg

D:\ENGINEERING DOCUMENTS\001688.OY12.24.02 M&B SED CAP CONSTRUCTION\POST CONSTRUCTION\SEDIMENT CAP CSR FIGS.DWG

3 Project Quantities and Costs

A summary of the project quantities (area of coverage and materials delivered and installed) is provided in Table 3-1.

A detailed summary of the RA construction quantities and costs is presented in Table 3-2. This table includes costs associated with sediment cap construction activities performed by Remtech, costs for DEQ management and DOJ legal support, costs for USACE assistance, and costs for engineering/consulting services performed by E & E and its subcontractors.

For the Remtech construction portion, Table 3-2 segregates contractual (i.e., bid) items from change order items. The total bid cost for all contractual items was $8,601,613. During the course of construction, 10 change orders were approved by DEQ (subsection 2.5). The total estimated cost for all change order work was $2,190,157. Additionally, a negotiated settlement which credited DEQ $66,318 was reached between DEQ and Remtech for work not performed by Remtech. In summary, the combined total estimated Remtech construction cost (contractual and change order) was $10,725,453.

DEQ management and DOJ legal support totaled $217,681. Assistance from USACE and AINW totaled $65,000. RA engineering and consulting services performed by E & E and its subcontractors totaled $1,564,060.

The total cost to implement the Sediment Cap Remedy between June 2004 and November 2005, plus the cost to import and stockpile topsoil for the Upland Soil Cap, is approximately $12,572,194.

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Table 3-1

SUMMARY OF CONSTRUCTION QUANTITIES
SEDIMENT CAP CONSTRUCTION
MCCORMICK & BAXTER CREOSOTING COMPANY SITE
PORTLAND, OREGON

Total Sediment Cap Construction Area	23 Acres
Amount of Sand delivered to the site by barge	130,944 Tons
Organoclay delivered to the site by truck	600 Tons
Articulated Concrete Block (ACB) delivered by truck	7,199 Tons, 31942 Square Yards
Filter Gravel delivered to the site by barge and truck	12,585 Tons
6" Rock delivered to the site by barge and truck	23,250 Tons
10" Rock delivered to the site by truck	23,300 Tons
Rip Rap delivered to the site by truck	568 Tons
Sand Overlay on ACB	9,914 Tons
Topsoil delivered to the site by barge and truck	110,000 Tons
Demarcation (Orange Construction Fencing)	35,457 Square Yards
Pilings Removed	1,601
Solid Waste Removed	2,700 Tons
Turf Reinforcement Mat (TRM)	23,400 Square Yards
TRM Staples installed	87,000

Table 3-2

SUMMARY OF CONSTRUCTION QUANTITIES AND COSTS
SEDIMENT CAP CONSTRUCTION (June 2004 through November 2004)
MCCORMICK & BAXTER CREOSOTING COMPANY SITE
PORTLAND, OREGON

Item	Description	Units	Unit Price	Estimated Quantity	Actual Quantity	Bid Amount	Final Cost
Construction Contract							
1. General							
1a.	Site Mobilization/Demobilization, General	Lump Sum	$781,467.00	1	100%	$781,467.00	$781,467.00
1b.	Construction Operations Plan, Contractor Quality Control Plan, Contractor Site Safety Plan, and All Other Submittals	Lump Sum	$296,146.00	1	90%	$296,146.00	$266,531.40
2. Removal, Consolidation and Off-Site Disposal							
2a.	Clearing, Grubbing, Debris Removal & Mgt. Of Large Woody Debris	Lump Sum	$16,610.00	1	100%	$16,610.00	$16,610.00
2b.	Removal of Dock Remnant and Bulkhead	Lump Sum	$17,183.00	1	100%	$17,183.00	$17,183.00
2c.	Removal of Pilings (Cut at Mud-line)	Each	$83.05	600	1151	$49,830.00	$95,590.55
2d.	Removal of Pilings (Pulled)	Each	$83.05	460	501	$38,203.00	$41,608.05
2e.	Removal of Barge , Concrete Foundation and Debris	Lump Sum	$49,545.00	1	100%	$49,545.00	$49,545.00
2f.	Sediment Well Abandonment	Each	$1,039.00	7	4	$7,273.00	$4,156.00
2g.	RCRA Hazardous Waste Handling	Tons	$600.00	2	0	$1,200.00	$0.00
2h.	Non-Hazardous Waste Handling	Tons	$64.00	1410	2,709	$90,240.00	$173,376.00
4. Sediment Cap Construction							
4a.	**In-Water / Shoreline Surveying**						
4a.1	Pre-Construction	Lump Sum	$8,730.00	1	100%	$8,730.00	$8,730.00
4a.2	Post-Construction	Lump Sum	$7,500.00	1	100%	$7,500.00	$7,500.00
4b.	**Sand Cap and Seep Treatment**						
4b.1	Sand Cap	Tons	$7.38	122,000	130,944	$900,360.00	$966,366.72
4b.2	Organoclay	Tons	$1.245	1,027,000	1,200,000	$1,278,615.00	$1,494,000.00
4c.	**Armoring**						
4c.1	Articulated Concrete Block	Lump Sum		1	100%	$2,681,705.00	$2,681,705.00
4c.2	Gravel Filter	Tons	$17.80	12,000	12,472	$213,600.00	$222,001.60
4c.3	10-inch Minus Cobble	Tons	$25.06	17,600	23,278	$441,056.00	$583,346.68
4c.4	Riprap	Tons	$43.02	1,950	558	$83,889.00	$24,005.16
4c.5	6-inch Minus Cobble	Tons	$21.95	23,250	22,378	$510,337.50	$491,197.10
4c.6	Sand (Armoring Overlay)	Tons	$12.75	17,700	9,914	$225,675.00	$126,403.50
4d.	Quality Control During Construction	Lump Sum	$116,500.00	1	100%	$116,500.00	$116,500.00
6	**Option A**						
A.1	Land Surveying	Lump Sum	$16,278.00	1	100%	$16,278.00	$16,278.00
A.2	Non-Hazardous Waste Handling	Tons	$65.00	335	0	$21,775.00	$0.00
A.3	Bank Regrade	Lump Sum	$96,577.00	1	100%	$96,577.00	$96,577.00
A.4	**Monitoring Wells**						
A4.a	Abandonment	Vertical Linear Feet	$42.22	200	393	$8,444.00	$16,592.46
A4.b	Modification	Each	$862.00	6	36	$5,172.00	$31,032.00
A.5	**Upland Treatment**						
A5.a	Demarcation Geotextile	Square Yards	$0.62	27,900	35,457	$17,298.00	$21,983.34
A5.b	Select Backfill	Tons	$13.00	20,450	60,000	$265,850.00	$780,000.00
A5.c	Topsoil	Cubic Yards	$13.92	7,220	0	$100,502.40	$0.00
A5.d	Vegetation	Lump Sum	$38,467.00	1	0%	$38,467.00	$0.00
A5.e	Turf Reinforcement Matting and Erosion Control Underlay	Square Yards	$10.15	21,240	27,370	$215,586.00	$277,805.50

A5.f	Select Backfill	Tons	$7.34		60,000		$440,400.00
A5.g	Select Backfill	Tons	$9.45		0		$0.00
A5.h	Locate, Survey, Protect & Cover (T&M)	Lump Sum	$72,525.40	1	108%		$78,327.43
7 Fish Exclusion Credit		Lump Sum	($4,000.00)	1	0%		($4,000.00)
CONSTRUCTION CONTRACT SUBTOTAL						**$8,601,613.90**	**$9,922,818.49**
Change Orders							
Change Order No. 1		Lump Sum					$69,000.00
Change Order No. 2 (purchase and place additional organoclay)		Lump Sum					$211,385.00
Change Order No. 3		Lump Sum					$0.00
Change Order No. 4		Lump Sum					$0.00
Change Order No. 5 (Import 150,000 tons Topsoil)		Lump Sum					$1,219,673.00
Change Order No. 6 (Miscellaneous Changes)		Lump Sum					$465,662.00
Change Order No. 7 (Delays from unforeseen conditions)		Lump Sum					$150,000.00
Change Order No. 8 R1 (Reduce topsoil to 120,000 tons; Additional monitoring wells; Extra sand stockpiling)		Lump Sum					($42,340.00)
Change Order No. 9 (Willamette Cove seep excavation; Turf reinforcement matting increase to 24,340 square yards;		Lump Sum					$73,295.00
Change Order No. 10 (Increase solid waste by 700 tons; Increase turf reinforcement by 3,660 square yards; Eliminate		Lump Sum					$43,482.00
CHANGE ORDER SUBTOTAL							**$2,190,157.00**
NEGOTIATED REDUCTION TO CONTRACT AMOUNT							**$66,318.00**
TOTAL CONSTRUCTION CONTRACT AMOUNT							**$10,725,452.90**
Other Construction Costs							
DEQ management and DOJ Legal Support							$217,681.00
USACE Assistance							$55,000.00
AINW							$10,000.00
Engineering and Consulting Support (Ecology & Environment):							
22.02	Sediment Cap RA Plans						$23,972.77
23.02	Sediment Cap Contractor Procurement						$89,800.95
24.02	Sediment Cap Contractor Management						$176,123.45
25.02	Residential Inspection						$1,102,841.19
27.02	Sediment Cap Remedial Action						$121,321.64
29.02	Sediment Cap Construction Summary Report						$50,000.00
E & E SUBTOTAL							$1,564,060.00
OTHER CONSTRUCTION COSTS SUBTOTAL							**$1,846,741.00**
TOTAL CONSTRUCTION COST							**$12,572,193.90**

Note: Costs include stockpiling of topsoil for Upland Soil Cap

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